IN ARDUIS FIDELIS

Non-mercurial treatment of syphilis page 568

note by F. J. Lambkin

Book-Post page 102

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A SUMMARY OF RECENT WORK ON THE CAUSE, PREVENTION, AND TREATMENT OF MEDITERRANEAN, OR UNDULANT FEVER, WITH SOME NOTES ON THE PATHOLOGY.[1]

By FLEET-SURGEON P. W. BASSETT-SMITH.
Royal Navy.

Historical Résumé of Recent Work.—The great prevalence of Mediterranean fever and the prolonged illness caused by it had constantly brought the disease under the consideration of those responsible for the well-being of the men in the Services, both at home and abroad. Not only were the hospitals at Malta and Gibraltar occupied by large numbers of men who had contracted the disease on the station, but the annual number of days' sickness and loss by invaliding to the Naval Service was enormous. Another very serious fact was the very large percentage of young and active officers attacked, who were often rendered incapable to perform their duty for many months.

In 1901, Lord Selborne, the First Lord of the Admiralty, was much interested in the matter, and a small naval enquiry was made by order of the Director-General, at Malta and Haslar, into the etiology of the disease. This demonstrated the following points:—

(1) The much greater vitality of the specific organism outside the body than had been before believed.

[1] Paper read before the United Services Medical Society, on December 12th, 1907, at the Royal Army Medical College, Millbank, S.W.

(2) The probable excretion of the organism by the urine.

(3) The growth of the organism in milk, without producing in it any external change.

In the report several recommendations were drawn up. Sir Patrick Manson, Medical Adviser to the Colonial Office, took a great interest in the question, and in 1904 the Secretary for the Colonies applied to the Royal Society to have an investigation made with regard to prevention. A joint Commission of Navy, Army, and Colonial Service was recommended and accepted, to work under an Advisory Committee of the Royal Society. A sub-committee of the Tropical Diseases Committee of the Royal Society was formed, consisting of Colonel D. Bruce, C.B., F.R.S., Chairman, Professor Klein, F.R.S., Dr. C. J. Martin, F.R.S., Dr. S. Martin, F.R.S., Sir A. Geikie, F.R.S., and myself; the working members at Malta being, at first, Staff-Surgeon Shaw, Major Horrocks and Dr. Zammit, with Dr. Johnstone, lent by the Local Government Board for epidemiological work. After the first year (1904) Dr. Johnstone fell out, and Lieutenant-Colonel Davies took his place, Captain Kennedy being added. In 1906, Davies, Horrocks and Shaw fell out, the two latter from ill-health, and their places were taken by Dr. Eyre, F.R.S.Ed., Majors McNaught, McCulloch and Weir, and by Staff-Surgeon Clayton, who remained on until the Commission was broken up.

After three years of most painstaking and thorough investigation of the disease by laboratory and epidemiological methods, definite conclusions as to the source of infection and methods for prevention were arrived at, which have since been put into practice with most satisfactory results. Since June, 1906, practically no fresh cases have occurred in the Navy. The monetary saving to the country and the Navy alone must, therefore, be very large, and a great source of anxiety has been removed from all employed on the Mediterranean station.

During the sitting of the Commission, no less than forty-one distinct articles were contributed, and an enormous number of experiments were made. These may be grouped under three headings: (A) Experimental. (B) Epidemiological. (C) Prophylactic.

(A) may again be divided into research on: (1) The saprophytic existence and vitality of the organism (three papers by Horrocks, one by Shaw, one by Bassett-Smith). (2) Methods of recovery of the organism from the blood, &c. (Gilmour, Shaw, Zammit, and Bassett-Smith). (3) Examination of breath, sweat, skin, &c. (Horrocks and Shaw). (4) Bacteriological examination

of cases of Mediterranean fever (Kennedy and Bassett-Smith). (5) Presence of organism in urine of Mediterranean fever patients (Horrocks, Kennedy, and Bassett-Smith). (6) Vitality of the organism in clothes, &c., infected with urine (Kennedy). (7) Virulence of the organism in the guinea-pig (Eyre). (8) Experiments on the modes of conveyance of the organism: (*a*) Contact, dust, &c. (Horrocks and Shaw); (*b*) by apparently healthy men (ambulant cases) (Shaw); (*c*) by infected goats, cows, &c. (Zammit, Shaw, Kennedy and Horrocks); (*d*) by mosquitoes, &c. (Horrocks, Kennedy and Eyre). (B) Epidemiological reports: (1) On the sanitary circumstances of the Maltese Islands (Johnstone). (2) Prevalence of Malta fever among British troops in 1905 (Davies). (3) Mediterranean fever at Gibraltar (Horrocks). (4) Epidemiological report, 1906, Navy (Clayton), Army (McCulloch and Weir). (C) Prophylactic researches: (1) Investigations on serums, toxins and vaccines (Shaw). (2) Investigations on anti-sera (Eyre).

The most important facts brought out step by step were: (1) The great vitality of the organism outside the body, when not exposed to direct sunlight. (2) The constant presence of the organism in the peripheral blood of cases suffering from the disease. (3) The escape of the organism from the body, chiefly through the urine. (4) The presence of the infective organism in the urine of apparently healthy men (ambulant cases). (5) Frequent infection of domestic animals, chiefly goats. (6) Infectivity of the urine and milk of these animals. (7) The high incidence of cases in patients and staff of hospitals. (8) The high incidence in officers, women, and children. (9) Occurrence of localised outbreaks (epidemic form). (10) Rare recovery of the organism from local mosquitoes, and very doubtful possibilities of their being distributors of the disease. (11) Complete cessation of cases where infected milk was removed from the dietary, or when it was properly sterilised.

During the first year of the Commission an enormous amount of experimental and laboratory work was undertaken to demonstrate the presence and vitality of the organism in soil, water, &c., and whether through these media it could be introduced into the body and cause the disease. The prevalent theories then were, that Mediterranean fever was due to sewage emanations (Hughes), or to the polluted dust of the Island carrying the disease to man, both ashore and afloat. The general results of the experiments were unfavourable to this latter method of infection, though it was found possible, with enormously large doses of heavily infected dust, to produce the disease in monkeys in a few instances.

The vitality of the specific organism outside the body was proved to be very great. When not exposed to direct sunlight, the soil of Malta became easily infected.

Next the infectiveness of the patients suffering from the disease was investigated, and it was found that the organism freely circulated in the peripheral blood throughout the whole course of the fever, though the minimum amount of blood necessary to give evidence of the *Micrococcus melitensis* was rather large (4 c.mm.) (Shaw). This presence in the peripheral blood of the infecting micro-organism gave considerable support to the theory that "blood-sucking insects" might convey the infection.

The paths by which the organism passed out of the body were next carefully investigated. All the secretions and excretions examined gave negative results until, by means of specially prepared nutrient media, Horrocks and Kennedy demonstrated that in the urine the specific organism was undoubtedly excreted. Many thousands of plates were made from patients suffering from the disease, giving a moderate percentage of recoveries (10 per cent.). Later the organism was found in the gall-bladder and abundantly in the mesenteric glands, proving that the chief paths of exit are the urine and the alimentary canal.

The next important step was made by Shaw, who demonstrated the presence of ambulant cases of the fever, whose blood reacted to the serum tests, and who were passing the infecting micro-organism in their urine.

Early in 1905, Zammit noted that the Maltese goats were to some extent susceptible to the disease, after feeding them with food containing living cultures of the *M. melitensis*. This investigation was followed up, and it was abundantly demonstrated that not only were the goats able to be artificially infected, but that about 50 per cent. of them acquired it naturally, and that they too were excreting the organism in their urine. From this it was but a step to thoroughly investigate the milk of such infected, though apparently healthy, goats, with the result that in Malta 10 per cent. of the animals were found to yield milk rich in the specific micro-organism of the disease, and that this milk, when taken as food by monkeys and other animals, was able to produce typical attacks of Mediterranean fever. Further direct proof of the infectivity of the milk to man was fortunately forthcoming in a peculiar epidemic of the disease in the *personnel* of the ship "Joshua Nicholson." This ship stopped one day at Malta to pick up sixty-five Maltese goats for export to America;

her crew consisted of twenty-three officers and men, most of whom drank freely of the milk. Eight of these contracted the fever; eight of the remainder left the ship at Antwerp and no further information about them was obtainable. Five of the goats died on the passage, and out of the remainder thirty-two were found to be infected on arrival in America.

During the last year of the Commission, much corroborative work was done by fresh investigators, and a thorough examination of the blood-sucking insects, &c., and their power to carry the disease was made. Horrocks and Kennedy had previously been able to demonstrate in four cases out of 450 the *M. melitensis* in the stomach of mosquitoes (*Culex pipiens* and *Stegomyia fasciata*), which had been caught in the fever wards of the hospital. The later work was, however, very unfavourable to the theory of mosquito infection. It was found that even if taken into the stomach, the organisms lived only four days, and that they were voided alive in the excreta.

In the report there are three excellent papers studying the disease from an epidemiological point of view, that of Staff-Surgeon Clayton, treating it from a naval standpoint, being to us the most interesting, from its thoroughness and lucidity.

The most important points in it are: (1) The connection of attacks with recent residence in Bighi Hospital was most fully proved, without showing particular prevalence in any ward or class of patients, a great number of cases developing the disease shortly after being discharged. (2) The high percentage of sick-berth and hospital staff affected, without direct relationship to their duties in the Mediterranean fever wards. (3) The absence of infection in the hospital ship "Maine," which carried numbers of patients in very close proximity, but in which ship fresh milk was not used. (4) The high incidence of cases in officers, as compared with men; this was 1 to 6, whereas the average percentage of officers to men in the fleet was 1 to 16. "The most curious feature is the difference between men and officers as regards previous hospital residence. It appears to be necessary for men to go to hospital to contract this fever in 50 per cent. of the cases, while the officer is enabled to do so without this in all but 11 per cent.—the explanation being that officers have milk in the ship, men do not, except when on the sick list; and that the officer is far more likely to take milk on shore than the men."

As regards methods of prevention; isolation of Mediterranean fever patients, the use of mosquito-nets, disinfection of effects,

and sterilisation of milk supply, were carried out, without any marked reduction of cases. During the first week of April, 1906, as the milk was suspected of not being properly sterilised, samples were taken, and found to contain the *M. melitensis*. From that time sterilisation for the hospital was efficiently done. Cases, however, continued to occur among the sick-berth staff, and it was found that these men had taken their milk separately before the sterilisation process, and had used it. Since August 4, 1906, fresh milk for the hospital and whole fleet has been boiled, or preserved milk has been used, with the result that from June up to the end of December, 1906, only three cases occurred in the Naval Hospital. (Two were in men who lived on shore and acknowledged that they took unboiled milk.)

During the present year (1907) there have been twelve cases treated in the Naval Hospital, Malta. These were made up as under :—

Maltese, chiefly domestics	4
English policemen in the dockyard, married to Maltese wives ..	2
Dockyard official	1
Domestics (English) living on shore	2
Seamen and marines from the fleet	3

The following table shows the incidence of cases for the last three years, in the Navy and in the civil population :—

	Admissions	
Date	Naval cases	Civil cases
1905	245	798
1906	131	724
1907	12	457

It can be definitely stated that since April, 1906, there has been a total cessation of cases contracted in the hospital. The preventive measures in the Navy may therefore be said to have èradicated the disease.

Very conclusive proofs of the "milk-infective theory" are also forthcoming from other sources, the most important being: (1) The practical disappearance of the disease from Gibraltar, following the removal of the infected goats. (2) The absence of the disease in the civil prison at Malta, with an average population of 185 persons, who are *not allowed milk*, the prison being situated in a populous district, where Mediterranean fever is common. (3) The great reduction of 90 per cent. cases among the military since fresh milk has been more or less efficiently sterilised. (4) The continued prevalence of the disease among the civil population, who are not under any control, the total cases registered for 1906 being 724, against

632, the average of the last ten years. The fact that the fever is present in many other parts of the world besides Malta is brought forward by some as opposing this milk-infective theory, but it must be borne in mind that Maltese goats have long been famous as good milkers, and have been freely exported into other countries; also that in America, India and South Africa efficient workers have been able to demonstrate that the goats there, with their milk, contain the *M. melitensis*. Again, the fact is brought forward that a number of men do not acknowledge taking milk of any sort, but in the face of the overwhelming evidence in Staff-Surgeon Clayton's report, one is forced to the conclusion that these statements are unreliable. It is, however, possible for infection to be contracted by preparations made from milk, both of goats and cows, and rarely by direct inoculation of the skin from infected clothing, &c.

Prevention by Vaccines.—At Malta some experiments were made on monkeys by members of the Commission to elucidate this point. Two monkeys were taken which had been given three separate injections of a specially prepared vaccine or dead culture of the *M. melitensis*, and two others which were quite healthy. All four monkeys were then given an injection of a living culture. The two former, or immunised, animals developed subsequently very slight fever, but in the latter, or non-immunised, typical attacks followed the injections; this showed a certain amount of protective action produced by the vaccine. From 1903-05, Dr. Eyre experimented with rabbits, goats and horses, and he states the results were by no means so encouraging as was anticipated.

In man, Sir A. E. Wright, in 1895, was unsuccessful in producing any immunity in his own person. In 1906, protective inoculations of vaccine were given to many of the staff at the Royal Naval Hospital, Malta, against natural infection; but as these were carried out at the time when milk was being efficiently sterilised, the results have been inconclusive. The question of "protective inoculations" in man by means of vaccines, therefore, remains *sub judice*.

Treatment of the Disease.—The extraordinarily protracted character of the disease, subject to such varying periods of latency and relapse, which are beyond the control of any medicinal methods of treatment, is well known. There is nothing that I have experienced more disheartening than to be surrounded by a ward full of these cases, to see one running a long-continued course of pyrexia, another showing the rising wave of a commencing relapse, and to feel powerless to cut short the one or prevent the other.

The treatment of the disease may be divided under three heads: (1) By *anti-sera*; (2) by *vaccines*; (3) by *drugs*.

(1) Wright first, in 1891, prepared and used an anti-serum against infected monkeys, with unsatisfactory results. In 1894, Aldridge applied the treatment to man, also with unsatisfactory results; the serum was used in a few cases at Haslar, but was discontinued. Eyre, in 1905, again experimented with an anti-serum in guinea-pigs, and once in man, still with poor results.

The evidence, then, so far is distinctly not encouraging with regard to this method of treatment.

(2) By vaccines of the *M. melitensis*, given during the course of the disease. Staff-Surgeon S. T. Reid, R.N., at Chatham Hospital, first published notes of nine cases treated there, in which the results were apparently fairly satisfactory. Since 1906 this treatment has been systematically carried out at Haslar, sixty-eight cases in all having received 243 injections of the vaccine, averaging 3·5 injections each. The vaccine was prepared there from a recent culture obtained during life from the spleen of a patient in the hospital. The vaccine was standardised for me by Dr. C. J. Martin, F.R.S., by weight of the dried organisms, giving 0·2 milligramme per cubic centimetre. The dose was generally from 0·25 to 0·5 cc. These injections were always given in the loin, after thorough preparation of the skin, &c. An interval of from one week to ten days was allowed between each injection, the amount and frequency being controlled by the opsonic index, this being frequently taken in accordance with the method devised by Wright and Douglas; the variations in the agglutinins being observed at the same time. These results have been fully reported in the *Journal of Hygiene* and *Journal of Tropical Medicine*. A negative phase was not always observed, but the rise was generally marked, lasting from four days to a week.

In acute cases I was not able to convince myself that the raising of the opsonic index had in the majority of cases any great influence on the course of the fever or symptoms of the disease, relapses occurring when the index was high. In a few cases the injection of the vaccine did apparently cut short a wave of pyrexia. In the more chronic forms of the fever the results were more satisfactory, there being relief from pain, gain in weight, and a general improvement in a number of the cases.

The reaction to the vaccine was comparatively slight, in only one case out of 243 did anything like an abscess occur; the pus from this was sterile and the abscess quickly healed; it appeared

to be a necrosis of tissue due to the local toxic action of the vaccine. In others there might be a slight local induration for a week. In only one was there any marked rise in the temperature, so that we may safely say that there is little danger in the procedure in chronic cases.

In acute cases, where there is an abundant and irregular production of toxin in the patient's system, the addition of even small doses artificially introduced is likely to give rise to only harmful results.

(3) By drugs. My own personal experience has been that we can depend on no drug to act specifically on the disease. Quinine in large doses is useless and harmful. Fresh chlorine water with quinine has appeared in a certain number of cases to cut short a relapse, but it is quite uncertain in its action. Cyllin has been spoken very highly of by Dr. Hartigan and Fleet-Surgeon McNabb, R.N., but in my hands was disappointing. Fresh yeast, given with the idea of increasing phagocytic activity, did not in any way alter the course of the disease. We are, then, left with the symptomatic treatment of each individual case, and here much may be done to increase the comfort of the patient and relieve urgent symptoms. In no case, I think, should a patient be allowed to pass frequent sleepless nights, when it is possible to give relief by the free administration of trional or other similar drug.

In the late stages, with slight fever and persistent neuritis, salicylate of quinine is often useful, with, locally, frequent small blisters, or high frequency applications. When the cachexia with anæmia is well marked, arsenic and iron, or if with an irritable heart, strychnine and iron, are most called for.

Notes on the Pathology.

When the *post-mortem* records of both man and animals are carefully gone through, the evidence of a general septicæmic infection of the body is very strong; for we find that, besides the fact of the organism being so frequently demonstrable in the peripheral blood, it occurs commonly in the deep-seated organs, &c. Bruce, Hughes, and others, have obtained the micrococcus from the spleen in acute cases during life; but even as late as the eighteenth month, in a chronic cachectic case, which no longer gave an agglutinative reaction, I have obtained a pure culture from the spleen. In another case, which occurred at the London School of Tropical Medicine, a patient suffering from an undulant type of fever suddenly developed symptoms of infective endocarditis; a pure culture

of the micrococcus was obtained from his blood, and at the *post mortem* recent endocardial ulcerations were present. Here we had an analogous condition to that produced by other septic organisms, as the pneumococcus and gonococcus. It must be evident to all who have dealt clinically with many cases of the disease, that this explains those severe cardiac symptoms and acute rigors which are sometimes met with.

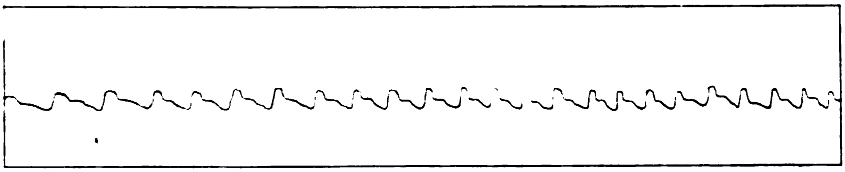
Besides the general infective symptoms, the organism, or its toxin, may at times produce marked local changes, giving rise to soft, fluctuating swellings over the sternum and ribs, &c., which are sometimes mistaken for abscesses. Among several of these cases, I well remember one who had a fluctuating tumour over the upper part of the sternum. From this I drew off some turbid fluid containing much cellular detritus, but no true pus, and from which the *M. melitensis* was isolated. Other swellings of a similar character were sterile, as if produced by the toxin alone, and resemble the localised indurations which occasionally take place at the site of the injection of a dead vaccine when used therapeutically. These should not be opened unless pus is certain.

From a long experience of cases I am impressed with the belief that though the organism may remain present for so many months in the body, ready to give rise to fresh attacks of pyrexia when favourable conditions of reduced phagocytic or diminished anti-bactericidal power of the serum are present, that there is besides a chronic irritative toxic condition produced, chiefly affecting the nervous system and giving rise to the recurring attacks of neuralgia, &c., so common in long-continued cases, which are analogous to those found in diphtheria and beri-beri. Clinically, more or less complete examples of paralysis of certain groups of muscles are seen, which in almost every case pass away completely. The toxic action on the heart is also shown by the irregularity of action, palpitation on slight exertion, tachycardia, and, in a few cases, bradycardia.

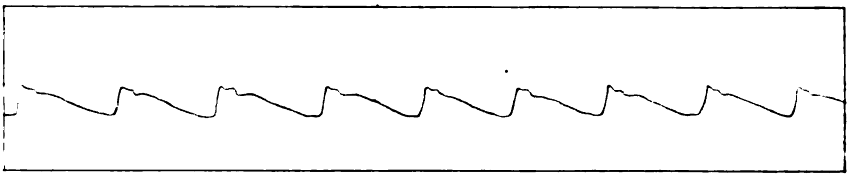
Pathological Lesions.—From the large number of animals examined by the late Commission, the commonness of the infection of the lymphatic glands was clearly demonstrated, and particularly the implication of the mesenteric glands, in those animals infected through feeding experiments. Shaw, in monkeys infected by feeding, found the organism in the mesenteric, axillary, and femoral glands, as well as in the liver, spleen, kidneys, and in the bile. In goats in the spleen and mesenteric glands. In cats in the mesenteric glands. Eyre came to the conclusion that in goats, in

acute cases of short duration, the spleen and mesenteric glands were chiefly infected, but that in old cases the inguinal glands appeared to be the last resting places of the *M. melitensis*, the infection of the kidneys and mammary glands being rather late phenomena. In man the micrococcus has been obtained in the heart blood, pericardial fluid, spleen, kidneys, liver, gall-bladder, pancreas, thyroid, salivary, supra-renal, mesenteric, inguinal glands, &c. Therefore, in the human subject the infection has by laboratory work been shown to be extensive.

It is difficult, or almost impossible, to demonstrate the micrococcus in sections; the organisms appear to be widely scattered in the tissue and never in large clumps, as in typhoid and plague, though they may be constantly found by appropriate culture methods.



Tachycardia.



Bradycardia.

PULSE-TRACINGS OF CASES OF MEDITERRANEAN FEVER, SHOWING GREAT VARIATIONS.

With regard to the morbid anatomy, the evidences of Mediterranean fever in uncomplicated acute cases are, as a rule, comparatively slight, for beyond congestion of the organs, with some cloudy swelling of the parenchymatous cells, not much is found, the enlargement of the spleen being most noteworthy. Hughes, in his *post mortems* of acute cases, found the average weight to be 19·9 ounces. Ulceration of the lower end of the small intestine occurs in a few cases—this is recorded by Hughes, and by Bousfield in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1906, and was seen in one of my cases. The intestinal ulcers do not correspond with the Peyer's patches, and are generally superficial in character.

In chronic cachectic cases of one or two years' duration, the

changes in the liver and spleen may be much more evident. At Haslar I have had only two deaths. In the first case the man died on the seventy-third day of the disease from heart failure, at the end of a long wave of pyrexia; his liver weighed 6 lb., the surface was smooth, the substance hard and pale; the spleen weighed 50 ounces, the capsule was smooth, the substance soft and one infarct was present. The micrococcus was isolated from the spleen after death. In the second case the man died after eighteen months' recurring attacks of fever, which produced excessive cachexia. The micrococcus was isolated from the spleen before death. *Post mortem*, the liver weighed 104 ounces, it was very hard and pale, the capsule was thickened, and the cut surface was mottled. Microscopically it showed a diffuse fatty degeneration, most marked at the periphery of the lobules, with marked round-celled infiltration in the portal canals spreading in the intra-lobular connective tissue between the degenerated liver cells. The spleen weighed 56 ounces, the capsule was thickened and spotted, the substance was firm and of a deep purple colour. Microscopically it showed an increase of fibrous tissue, a marked increase in endothelial cells with many multinucleated ones, and a decrease of lymphoid tissue. The intestines showed small superficial ulcerations near the cæcum, and the mesenteric glands were enlarged. The changes in the liver and spleen would appear to be due to the chronic irritative action of the specific organism. Such extreme enlargement has not, as far as I know, been described before, and is liable to give rise to errors in diagnosis.

In conclusion, I would most emphatically point out that the terms "Malta and Mediterranean Fever" are both wrong and misleading, that though lately the term "Septicæmia of Bruce" has been recommended, the old suggestion of Hughes that the disease should be called "Undulant fever" is by far the most distinctive and satisfactory of any that have ever been employed, and I would recommend that the College of Physicians should be urged to incorporate this in the Nomenclature of Diseases.

DISCUSSION.

Lieutenant-Colonel W. B. LEISHMAN, R.A.M.C., remarked on the pleasure with which the Society had listened to so excellent a paper. He wished, however, to call attention to one grave omission, namely, any reference to the important work done in connection with Malta fever by Fleet-Surgeon Bassett-Smith himself. Colonel Leishman laid stress on the fact that the incidence of Malta fever among the civil population

of the Island was as great as ever, and suggested that, in view of the difficulties of enforcing preventive measures, it was very desirable that researches should be continued to determine the mode of transference of Malta fever from goat to goat. The disease might be attacked along the line of active immunisation of these animals by injection not of dead cultures of *Micrococcus melitensis*, which appeared to have given irregular results, but of attenuated living cultures on the original lines of Pasteur. Colonel Leishman added that such attenuated living vaccines had given good results in the prevention of other bacterial diseases of animals, and also, in the case of Haffkine's cholera vaccine, in man; while Strong, of Manila, had recently obtained good results from vaccination of men with attenuated living cultures in the case of plague.

Lieutenant-Colonel A. M. Davies, R.A.M.C., called attention to the fact that, in 1905, even after strict orders had been issued that all milk used by the garrison and men-of-war at Malta should be boiled, the incidence of Malta fever continued undiminished. He thought that this fact could hardly be explained by mere carelessness or neglect of duty. Besides, he added, the Royal Garrison Artillery, mostly old soldiers (and their families), drank hardly any goats' milk at all, and yet showed a percentage of Malta fever as high as the other troops. In one regiment, where no attempt was made to boil the milk, there was actually a lower percentage of Malta fever cases than elsewhere. From these facts Colonel Davies was inclined to doubt whether milk was the *only* source of infection. He thought that the mosquito might yet be found to act as a carrier of the *M. melitensis*.

Lieutenant-Colonel D. V. O'Connell, R.A.M.C., agreed with Colonel Davies' remarks, and added that, although he had never touched a drop of goats' milk during his stay at Malta, yet he developed severe Malta fever. He considered that opium was a valuable drug in the treatment of the disease, and stated that he himself had experienced great benefit from hypodermic injections of morphine during the febrile paroxysms. He considered that bromides were useless.

Fleet-Surgeon P. W. Bassett-Smith, R.N., in replying briefly, said that he thought the Maltese would raise no objection to immunisation experiments among their goats if they were threatened with destruction of infected animals. He considered that the prevalence of Malta fever in the garrison after all milk was ordered to be boiled was due to insufficient boiling. He also considered that the phenomenal success of the Malta Fever Commission was a strong argument in favour of vivisection, as the magnificent results could never have been obtained without experiments on living animals.

The Chairman, Inspector-General Sir Herbert Ellis, K.C.B., K.H.P., Director-General of the Royal Navy, proposed a vote of thanks to Fleet-Surgeon Bassett-Smith for reading his paper, which was carried by acclamation, and the proceedings terminated with an exhibition of objects of interest in the Pathological Laboratory.

TUMBU-FLY DISEASE IN SIERRA LEONE.

By Major F. SMITH, D.S.O.
Royal Army Medical Corps.

In Appendix No. V. (2) to the *Army Medical Department Report for the Year* 1898 (p. 466) is a note by myself on the occurrence of this affection among the troops engaged in the Mendi Expedition. I was at that time under the impression that the disease was uncommon, partly because a local doctor professed ignorance of it. Probably it was less common in the part of the Mendi country referred to than it is in Freetown and the Timini country.[1] In my former note the disease was ascribed to the laying of the fly's eggs under the skin, and the suggestion was made that the insect was the *Œstrus livingstonii.* The larva of the Tumbu-fly burrows beneath the skin of human beings and other animals, and becomes stationary. The cavity in which it lives is not cut off from the external air; an opening is always left, and in or near this the posterior end of the maggot lies. When mature it drops out, burrows into the ground, and becomes a pupa. The flies, from larvæ placed on earth after I had forced them prematurely out of their residences in rats and dogs, appeared on the sixteenth and seventeenth day. Possibly in the case of mature larvæ the period would be less.

In the human being the appearance of the lesion produced by the larva is that of a raised, reddish patch; on a clean washed skin it looks something like an urticarial wheal. At some part of this swelling will be seen a tiny opening, or a moist spot, perhaps a blackish mark, according to how much, if any, of the larva is presenting at the opening and to the stage of growth. In some cases where the skin has not been washed, pus may have exuded and scabbed around the orifice, so that the appearance is that of a broken boil. There is intense itching in and around the spot. Strong pressure towards the opening forces the larva out easily enough, so that in adults familiar with the fly the larva does not get a chance to grow very big, unless it happens to be in a part where the sufferer cannot see what is wrong. In neglected children and helpless people the larva is able to grow to its full size. In such cases there is usually suppuration in the cavity, and it is common on ejecting the intruder to see a bleb of pus follow it out.

[1] The Mendi name for the fly is "Boyeh"; "Tumbu" is a Negro-Creole word.

I have not heard of any serious results from the attacks of this larva, but as affording an avenue of entry for germs, it seems likely that bad effects may occasionally follow a "tumbu" lesion.

I have found "tumbu" in men, dogs, monkeys, rats and imported guinea-pigs, and in all cases the larvæ appeared to belong to the same fly. Insects developed from larvæ from the dog and rat have been sent home for comparison with those which Mr. Austen obtained from a monkey.

Mode of Access.—Among Europeans (and they do not often get "tumbu") a usual site is the scrotum—not an easy place for the fly to reach, one would think. In negro natives the head is sometimes the place of choice, but no part of the body is exempt. Babies at breast and carried in a cloth on their mothers' backs are often afflicted with "tumbu." My first doubts as to the correctness of the accepted mode of infection by the laying of the egg or larva in the skin arose from observation of the situation of the lesions in animals. A wild rat had six "tumbus" in the bare underpart of his legs and feet; the limbs, of course, were immensely swollen. It seemed unlikely that a large fly would get the opportunity of depositing its ova in a rat's legs—moreover, the rat is generally not abroad in the day-time when the fly is out. Small pups suffer much more than adult dogs, and the larvæ are all over them, but chiefly on the belly and legs. In monkeys the tail is a favourite seat of "tumbu." All the parts mentioned are those that are frequently on the ground.

On careful enquiry from my native boys, I found that, after elimination of various fairy-like modes of acquiring the disease, such as by the maggots dropping off tall trees on to the heads of persons beneath, they agreed that the ordinary and commonest manner of infection is from the ground. The information was given, without any leading question, that the flies deposit their offspring in the ground, commonly on the earthen floor of a hut, and the larvæ enter the skin of the person or animal sleeping on the ground. Still, it may be imagined that the flies occasionally select a part of the body on which there may happen to be a collection of filth. Presumably the larvæ require soil containing organic matter to live on, and can do without a mammal host if necessary. The larva which reaches the scrotum has probably begun life in the dirt on the underside of the closet-seat, and the scrotal rugæ protect it while it is making a home for itself.

So, then, we may say, "tumbu" is one more to add to the list of the plagues of life due to want of attention to sanitary matters.

OBSERVATIONS ON TUMBU-FLY DISEASE.

By Major A. P. BLENKINSOP.
Royal Army Medical Corps.

Definition.—A parasitic disease caused by the growth of the larva of the Tumbu-fly in the skin and subcutaneous tissues. It is of frequent occurrence on the West Coast of Tropical Africa; and the following notes are the result of observations made in Sierra Leone.

Parts Affected.—In the majority of cases, only a single larva is found in an individual at one time; but I have seen fifteen present in one case, and have heard of as many as twenty-four being found in the same stage of development in another patient. In Europeans the upper parts of the thigh and the buttock are the favourite sites for the larvæ to gain an entrance under the skin, and it is a generally received opinion that the parasites are often acquired at the latrine. In one European case I found a larva in the forearm, and in another, where the patient was in the habit of lying on his bed during the heat of the day in an almost nude condition, the characteristic sores appeared simultaneously on the chest, back and legs. Among the West Indian troops serving on the Coast the parasite frequently affects the axilla. Perhaps this may be accounted for by the men, when off duty, wearing only short-sleeved vests, or rolling their shirt-sleeves almost up to their shoulders. Among the partly clothed natives of the Sierra Leone Protectorate its site may be very varied, and no special region seems to be selected.

Character of the Lesions.—The lesions strongly resemble *furunculi*, and are at first frequently mistaken, both by patients and practitioners, for ordinary boils. They take at least ten days or a fortnight to attain full development; but patients usually give a much shorter history, as they cause little or no inconvenience in their earlier stages. Though at times extremely painful, they do not incapacitate a man for work unless they affect the axilla or excite secondary inflammation of lymphatic glands. When nearly fully developed a small central area, apparently of suppuration, is found surrounded by an areola of inflammation from ¾ to 1 inch in diameter. On careful examination of the central area some black matter, the excrement of the larva, is seen immediately beneath the skin surrounding the minute breathing aperture. If

this point is very gently pressed with the tip of the finger, intense pain is caused, probably by the movement of the larva. In some cases, where the sore is irritated, an abscess is produced, and in one case three dead larvæ were evacuated from an abscess cavity situated beneath the skin of the axilla. In ordinary cases the pain, though severe, is paroxysmal, and the intense, continuous throbbing frequently experienced in ordinary boils, is absent. If allowed to run its course, the larva leaves its nidus spontaneously when fully developed. Only the skin and subcutaneous tissues are affected, and the larva does not, like that of the Screw-worm Fly (*Chrysomyia macellaria*, Fabr.) in North and South America, burrow into the deeper tissues.

Differential Diagnosis.—The following points may serve to differentiate the sores from boils: (1) The presence of the black excrement around the breathing aperture of the larva; (2) the pain caused by gentle and continuous pressure on the breathing aperture; (3) the paroxysmal character of the pain, which is generally unaccompanied by throbbing.

Treatment.—The larva can usually be easily removed entire with the point of a surgical needle, and, if uninjured, is very active in its movements for some time after its withdrawal. The small resulting wound heals rapidly if washed out with 1 in 20 carbolic lotion and covered with an antiseptic wool dressing. On healing it leaves a small depressed scar, which is usually more or less pigmented. When suppuration has been excited, a free incision is of course required to evacuate the pus. In one case under my care, in which there were several larvæ present at the same time, the patient had applied a plaster of sugar and soap to some of the sores, and the larvæ appeared on the surface in less than twelve hours in every case he had thus treated. This result was probably obtained by blocking the breathing aperture with the plaster.

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THE TUMBU-FLY (*CORDYLOBIA ANTHROPOPHAGA*, GRÜNBERG).

By E. E. AUSTEN, F.Z.S.
Zoological Department, British Museum (Natural History).

BEFORE giving a description of the remarkable insect referred to in the foregoing communications from Majors Smith and Blenkinsop, a few words may perhaps be said as to the manner in which infestation by the larva takes place. According to Major Smith's Mendi hammock-boys, the maggot at first leads a free and independent existence on the earthen floor of a hut, and burrows its way beneath the skin of its future host when the latter is asleep. This portion of the fly's life-history has not yet, so far as the present writer is aware, been investigated by a competent observer; and although it is quite possible that the Mendi idea accepted by Major Smith is correct, the story is so curiously similar to the now well-known life-history of the "Floor-Maggot Fly" (*Auchmeromyia luteola*, Fabr.) as to suggest that the natives, like certain Europeans, have mistaken the one species for the other. We do not yet know whether the Tumbu-fly is oviparous or viviparous, but in either case, since the female is undoubtedly unable to pierce the skin with her ovipositor, the larva in its earliest stage must bore its own way through the integument by aid of its mouth-hooks. If the Mendi belief is not correct, the egg or minute larva must be deposited upon the clothing or skin of its host, where, assuming the fly to be oviparous, the heat of the victim's body would no doubt soon cause the egg to hatch. In the case of Europeans or other human beings wearing clothes, the larva, by crawling along the clothing, might be able to reach spots inaccessible to the parent fly. It is interesting to observe that in Rhodesia, where the fly is very common and the maggot often infests babies,[1] as also in British Central Africa, the belief prevails among white people that the fly enables its progeny to

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[1] *Cf.* G. A. K. Marshall, *Transactions of the Entomological Society of London*, 1902, p. 540. Writing from Salisbury with reference to the fly on April 19th, 1901, Mr. Marshall said: "It has been a great scourge this year in Salisbury, especially among young babies, the maggots forming a painful boil-like swelling under the skin. One baby had no less than sixty maggots extracted from it, and there have been several cases in which they have had a dozen or more."

obtain access to the human body by depositing its eggs upon flannel or woollen clothing hung out to dry, with the result that, in Central Africa at any rate, it is stated that the wearing of flannel clothing has been found to be impossible. If this is so, the ovipositing fly must be attracted by the odour of the clothing; but, since not only Europeans but also unclothed natives, as well as monkeys, dogs, and other animals, are similarly afflicted, it is obvious that the

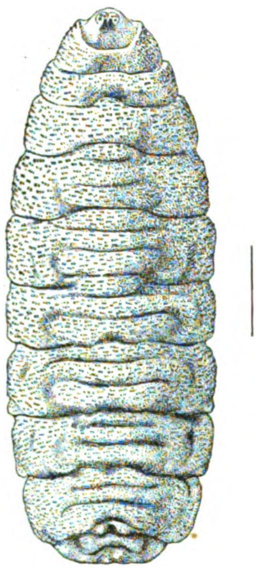

Fig. 1.—Full-grown Larva of the Tumbu-fly (*Cordylobia anthropophaga*, Grünberg). Ventral view. × 6.

life-history does not always take the same course. At the same time it must be admitted that the Mendi idea alluded to above is apparently shared by natives in the Congo Free State. This is shown by a recent communication from Dr. A. Yale Massey, late of the Tanganyika Concessions, Limited, who, in forwarding for identification five larvæ of *Cordylobia anthropophaga*, or of a closely allied species belonging to the same genus, from the south-east of the Congo Free State, wrote as follows from Kansanshi, North-western Rhodesia, on April 10th, 1907: "The larvæ were extracted from swellings in the groin of a white man, one of our

prospectors, who thought he had buboes. The locality is about 9° 30′ S., in the Congo State. The natives say that the trouble arises through sleeping on grass beds."

It is hoped that the following description of the different stages of the Tumbu-fly will enable those who may come in contact with it to recognise the insect.

Larva.—The full-grown larva is a fat, yellowish-white maggot, 12 to 12½ mm. (about half an inch) in length, bluntly pointed at the anterior or cephalic extremity, and truncate behind; its greatest breadth (on the sixth and seventh segments) is 5 mm. The body consists of twelve visible segments, the divisions between which are strongly marked, except between the cephalic and first body-segment (the latter of which bears the anterior or prothoracic stigmata, or respiratory apertures), and between the eleventh and twelfth segments. On the under side of the cephalic segment the tips of the black paired mouth-hooks may be seen protruding, while in a slight depression on the flattened posterior surface of the twelfth segment are situated the paired posterior stigmatic plates. In an adult larva the slit-like apertures in these plates are not very easy to distinguish, but in a maggot in the second, or penultimate stage, it is seen that each plate bears three ridges of tawny-coloured chitin; these ridges run obliquely downwards and outwards, at an angle of 45° from the median vertical line, and, while the median ridge on each plate is nearly straight, the other two ridges are characteristically curved, resembling inverted notes of interrogation, with the concavity directed towards the median ridge. The segments of the body are transversely wrinkled on the dorsal and ventral surfaces (especially on the latter), and puckered on the sides. From the third to the eleventh segment the body is thickly covered with minute recurved spines of brownish chitin (darker in the case of larvæ ready to leave the host), usually arranged in transverse series or groups of two or more, which can be seen to form more or less distinct, undulating or irregular, transverse rows. These spines will be described in somewhat greater detail below.

Above and to the outer side of each mouth-hook is an antenna-like protuberance ("maxilla," of Lowne), which, as in the case of the larva of the Blow-fly (*Calliphora erythrocephala*, Mg.), exhibits a pair of light brown, ocellus-like spots, or rather papillæ, placed one above the other; according to Lowne's interpretation in the case of the Blow-fly, these are sensory in function. In a small larva, 5 mm. in length, from Lagos, the papillæ are very clearly

visible; each papilla is surrounded by a ring of pale brownish chitin, and its shape, when viewed from the side, is exactly that of the muzzle of an old-fashioned muzzle-loading cannon.

This small larva also shows on the basal segment of each antenna, or antenna-like protuberance, below and a little to the outer side of the mouth-hook, a prominence bearing a series of about six small, brown-tipped, chitinous spines. These prominences are evidently the same as those referred to by Coquerel and Mondière[1] as "deux appendices analogues (palpes ?) plus petits, munis de quelques épines très fines vers leur bord interne," and clearly shown in their figure (Pl. 3, 1b). In the same larva the spines on the body are most conspicuous, and most strongly developed and chitinised, on the fifth, sixth and seventh segments. The tenth and eleventh segments are also covered with spines, but, since the chitin of which they are composed is not tinged with brown, these segments appear bare. In the adult larva also, the spines on the tenth and eleventh are less conspicuous than those on the preceding segments; on the twelfth segment, which bears the posterior stigmatic plates, the spines are very minute. Fully chitinised spines are dark brown, but this colour is generally confined to the apical half of the spine, or may be absent from the extreme base. In shape each spine is a short cone, with the apex recurved, pointing towards the hinder end of the body. The spines are broad at the base in proportion to their length, and not infrequently, especially on the under side of the body, are bifid at the tip. They are closest together and most strongly developed on the anterior portion of each segment, becoming smaller and showing a tendency to disappear towards the hind margin. They are arranged in irregular transverse rows, which are usually seen to be composed of groups of from two to five spines, placed side by side.

In the adult larva the median area of the ventral surface of segments five (or six) to eleven inclusive is marked with a series of three transverse ridges, which are most prominently developed on the seventh and following segments. On each segment the foremost ridge is the shortest; next in length comes the hindmost, and the middle ridge is the longest of the three, curling round the posterior ridge at each end. Similar but less strongly marked ridges are seen on the dorsal surface.

[1] *Annales de la Société Entomologique de France*, 4ième série, t. ii. (1862), p. 97.

In 1897, the late Professor Friedrich Brauer described[1] a Muscid larva in the third stage (7 to 8 mm. long by 3 mm. broad) from the skin of a European at Tanga, German East Africa; and also a smaller larva (3 to 5 mm. long), in the second stage, from the Arabian shore of the Red Sea. Professor Brauer showed that both belonged to the same species, and, from the description given by

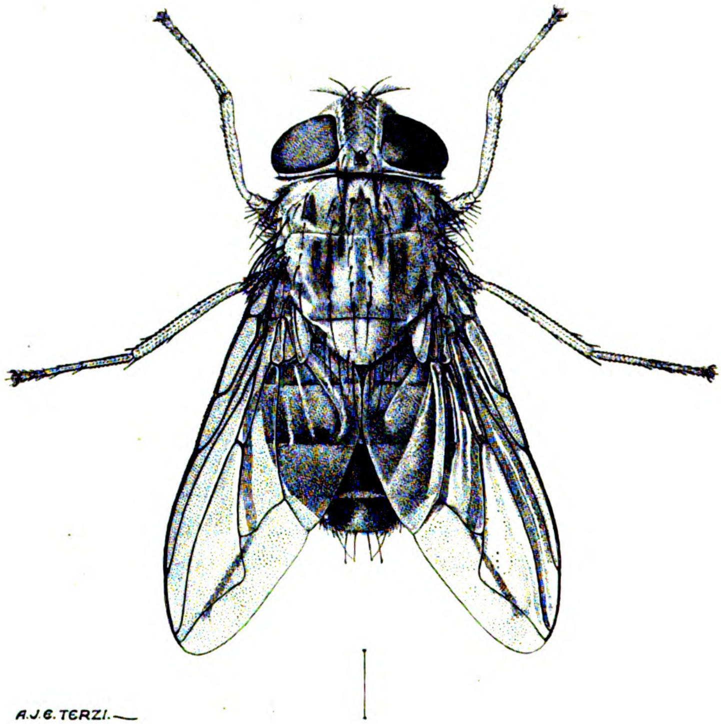

FIG. 2.—THE TUMBU-FLY (*Cordylobia anthropophaga*, Grünberg). Female. × 6.

him of the larger larva, and especially his remarks as to the arrangement of the spines ("on the middle segments, too, they are arranged in peculiar fashion, four or five close together in a row, so that a number of such short rows are to be seen side by side or one behind the other"), there can be little doubt that this East African parasitic Muscid is none other than *Cordylobia anthropophaga*,

[1] *Denkschr. math.-naturw. Cl. K. Akad. Wiss.*, Bd. lxiv. (1897), p. 271.

Grünb. It is possible, however, that a second species of *Cordylobia* occurs in British East Africa, since in the case of a large series of larvæ belonging to this genus in the collection of the British Museum, removed from the skin of an Irish terrier at Maungu, East Africa Protectorate, where the parasite is said to be known as the "Maungu worm," the spines are simply scattered singly, instead of being arranged in transverse groups or series, and are also distinctly larger than in the case of Tumbu-fly maggots from Sierra Leone and Lagos, although the larvæ themselves are smaller.

Puparium.—Of the usual barrel-shaped Muscid type. Average dimensions: length 10⅓ mm., greatest breadth 4⅔ mm. Though at first of a ferruginous or light chestnut tint, the puparium gradually darkens until it becomes "seal brown" or practically black.

Perfect Insect.—A thick-set, compactly built fly, of an average length of about 9½ mm.; specimens as small as 6½ or as large as 10½ mm. in length are occasionally met with. Head, body and legs, straw yellow; dorsum of thorax and of abdomen with blackish markings; wings with a slight brownish tinge. The eyes meet together for a short distance in the median line above in the case of the male, but are separated by a broad front in the female (*see figure*). On the dorsum of the thorax the dark markings, which are a pair of longitudinal stripes not reaching the hind margin, are covered with a greyish bloom and, consequently, not very conspicuous; this bloom is also present on the abdomen, but here the markings are much more distinct, especially in the female, in which the third segment, as also the fourth segment with the exception of the hind margin, is entirely black or blackish. In the female the second segment is marked with a blackish quadrate median blotch, and has a similarly coloured hind border, broadening towards the sides, while the first segment has a narrow dark hind margin. In the male these markings are not so extensive; the dark hind margin to the second segment is interrupted on each side of the median blotch, which is triangular in shape, and there is a yellow area of considerable size on the proximal half of the third segment, on either side of a blackish median quadrate blotch; the fourth segment is similarly but less conspicuously marked.

Care is necessary in order not to confuse *C. anthropophaga*, Grünb., with *Auchmeromyia luteola*, Fabr. (the "Floor-Maggot Fly"), which is found in the same parts of Africa and presents a deceptive resemblance to the Tumbu-fly in coloration, since it also has a pale yellow head and body, with dark markings on the thorax, and the distal half of the abdomen blackish. Without going too

deeply into details, however,[1] it may be said that the two species may be distinguished by the fact that in *A. luteola* the eyes are wide apart in both sexes, the body is narrower and more elongate, the hypopygium of the male is in the form of a conspicuous forwardly directed hook, for which the ventral half of the penultimate segment of the abdomen serves as a sheath; and lastly, by the fact that the second abdominal segment in the female is twice the length of the same segment in the male. The "floor-maggot" itself is devoid of the characteristic spines described above in the case of the Tumbu-fly larva, and the posterior surface of its last segment, instead of being vertical, as in the latter, slopes backwards at an angle of 45°, and has around its hind margin a series of fleshy spines;[2] the stigmatic plates on this segment, too, are extremely small and wide apart (2 mm. apart in an adult larva), while in the Tumbu-fly maggot they are much larger and close together (at the nearest point separated by less than the diameter of a single stigmatic plate).

Within the last few years *C. anthropophaga* has been wrongly identified as *Bengalia depressa*, Walk., under which name it has frequently been referred to in reports on "Economic Zoology" and other literature. The true *B. depressa* however, is a very different insect, the life-history of which is unknown, and there is no evidence whatever to show that its larva is a subcutaneous parasite.[3]

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[1] A brief description of *A. luteola* by the writer will be found in the *British Medical Journal*, January 30th, 1904, p. 246; on the previous page Captain P. S. Lelean, R.A.M.C., gave a figure of the female fly. The author also figured the perfect insect and its larva in Allbutt and Rolleston's "System of Medicine," vol. ii., part ii. (1907), p. 184.

[2] For the original description and figures of the "floor-maggot," see Drs. J. E. Dutton, J. L. Todd, and C. Christy, "Reports of the Trypanosomiasis Expedition to the Congo, 1903-1904," of the Liverpool School of Tropical Medicine and Medical Parasitology (London: Williams and Norgate, 1904), pp. 49-54, pl. iii., and figures of larva in text.

[3] For the explanation of the manner in which the confusion with *B. depressa* has arisen, as also for an historical account of the Tumbu-fly, see Austen, *Proceedings of the Entomological Society of London* for the year 1907, pp. xliii.-xlvii.

THE RELATIONSHIP OF THE TEMPERATURE AND MOISTURE OF THE ATMOSPHERE TO THE INCIDENCE OF HEAT-STROKE.

(Communicated to the Berlin International Congress of Hygiene, 1907.)

By Major LEONARD ROGERS.
Indian Medical Service.

There are two different conditions produced by exposure to the sun or excessive heat: firstly, syncopal attacks, usually induced by the action of the direct rays of the sun, often aided by excessive exertion, such as when troops march on a hot day; and secondly, hyperpyrexia following prolonged high atmospherical temperature, with or without exercise, and usually without actual exposure to the sun, such as attacks stokers in ships in hot climates. Intermediate conditions combining some degree of both the above states also occur.

As a rule the syncopal form, or sunstroke proper, is rapidly recovered from under suitable treatment; but true heat-stroke, with hyperpyrexia and loss of consciousness, is a much more serious and often fatal condition of common occurrence in certain tropical climates, and especially in India, where it has been studied by Longmore, Fayrer (who read a paper on insolation at the International Medical Congress in 1881), and many others, all of whom agreed that the incidence of the affection is closely related to waves of excessive atmospherical heat.

More recently it has been suggested by L. Sambon, and endorsed by Sir P. Manson and others, that the disease may be of microbic origin. In support of this theory they state: (1) It prevails only in low-lying or sea-coast districts and the valleys of certain rivers, and is never found above 600 feet elevation; (2) its distribution is capricious and irrespective of the atmospherical temperature curve; and (3) attacks occur mostly at night, when the air temperature is not at its highest point; for which reasons they assert that it cannot be caused by heat alone.

In order to test these statements, which are at variance with medical experience in India, and moreover leave out of sight the very important factor of the amount of moisture in the air, I have obtained the records of the heat-stroke cases in the British Army in India for three consecutive years, thanks to the kindness of the officers of the Royal Army Medical Corps, and compared their

incidence with the meteorological conditions in the same places and on the same days on which they occurred, for which data I am indebted to H. W. Peake, Esq., of the Bengal Meteorological Office. The results may be summed up by saying that they totally disprove each of the above statements, and show an exact relationship between the meteorological conditions and the incidence of heat-stroke, as will appear from the following analyses and tables, from which cases of sunstroke have been excluded. The very varying nature of the climate in different parts of India makes it a peculiarly favourable field for such a study. As it is well known to everyone with tropical experience that a given degree of heat is much more unbearable if accompanied by excess of moisture than if the air is dry, the percentage of saturation of the atmosphere with vapour has been taken into account, as well as the actual temperature, and has furnished most important data. The following are the principal facts which have emerged from this inquiry.

TABLE I.—MONTHLY INCIDENCE OF HEAT-STROKE IN INDIA.

Part 1. Fatal Cases.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Total ..	—	—	—	—	7	31	17	4	3	—	—	—	62

Part 2. Total Cases.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Punjab	—	—	—	—	5	73	124	24	3	—	—	—	229
United Provinces and Bengal	—	—	3	2	11	57	22	17	10	1	—	—	123
Central India ..	—	—	—	1	10	16	1	—	—	—	—	—	28
Bombay ..	—	—	2	4	7	9	7	4	—	—	—	—	33
Madras	—	1	1	1	2	3	—	—	—	—	—	2	10
Burma	—	—	—	—	2	—	—	—	—	—	—	—	2
Total ..	—	1	6	8	37	158	154	45	13	1	—	2	425

The Monthly Incidence of Heat-stroke.—In the first part of Table I. are shown the fatal cases of heat-stroke in each month of the year, and in the second part the total cases are given. It will be observed that every single fatal case occurred during the hot months from May to September, while three-fourths of such cases took place in the two hottest months, June and July, and half the total in the one month of June, which has the highest temperature of the year in most parts of India. Further, the maximum incidence in different parts of India is in the hottest month of the particular province, this being in July in parts of the Punjab, where the monsoon is scanty, but in June in the United and Central Provinces, which are cooled by the south-west monsoon setting in

by July. The total cases show the same distribution in a slightly less pronounced manner, for 95 per cent. occurred between May and September, and 2 per cent. more in the very hot month of April. The remaining 3 per cent. were nearly all in the Madras and Bombay Presidencies, where there is little or no cold weather, and it may be hot at almost any time of the year. Moreover, a few cases of sunstroke, cerebral malaria, or other diseases may have crept into the returns.

Degrees of Heat and Moisture Associated with Heat-stroke.— Next we will consider the moisture and temperature of the air at the time of the occurrence of heat-stroke cases. The data available are the daily maximum, minimum, and mean temperatures, and the percentage of moisture in the air. The strength and direction of the wind were also studied, but, except that most cases occurred on calm days, these were of less importance than the other data. As the diurnal variation of the temperature in the hot weather, in the parts of India where most heat-stroke cases occur, averages about 20° F. (9° C.), while it is the prolonged exposure to a temperature approaching blood-heat, rather than a short time in very excessive temperatures, which is most exhausting to the human system, so the daily mean temperatures appear to be the most useful data to study. The cases have, therefore, been classed in groups according to the mean temperature of the twenty-four hours in which they occurred, and further subdivided as regards the percentage of saturation of the air with moisture, as in Table II. The series of fatal cases has also been separately classed, to show the maximum temperature of the day on which they occurred, as this will be very near to the actual air temperature when the great majority of the attacks happened; because, as will be shown later, as a matter of fact, three-fourths of the patients were admitted to hospital during the hottest period of the twenty-four hours. As a glance at the table shows that heat-stroke occurs at a much lower mean temperature, when a high degree of moisture is present, than when the air is dry, the percentage of cases under each ten degrees of moisture has been worked out for the different mean temperature-periods shown in the table, in order to bring out this important relationship more clearly.

Taking first the fatal cases, we find that only one occurred with a mean temperature below 85° F. (29·4° C.), and seven more between 85° and 89° F. (29·4° to 31·6° C.). In all but one of these the moisture in the air was over 70 per cent. of saturation, and in half of them it exceeded 80 per cent., very moist atmospheres,

which greatly interfere with that free evaporation of perspiration by means of which the body is so greatly cooled in tropical climates. A mean temperature of 85° to 89° F. corresponds with a maximum one of about 95° to 99° F. (35° to 37·2° C.), or about blood-heat; so that fatal heat-stroke cases very rarely occur until a maximum air temperature of about bood-heat is reached, and then only when a high degree of moisture is also present.

TABLE II.—DEGREES OF TEMPERATURE AND MOISTURE ASSOCIATED WITH HEAT-STROKE.

Part 1. Fatal Cases.

		Percentage of moisture in the air									
		—31	31—40	41—50	51—60	61—70	71—80	81—90	+90	Total	Percentage
Maximum air temperature	—95	—	—	—	—	1	3	3	—	7	11·3
	95—99	—	—	—	—	1	2	1	—	4	6·5
	100—103	—	1	2	—	8	1	—	—	12	19·4
	104—108	2	2	1	5	4	2	—	—	16	25·5
	108	1	7	9	2	4	—	—	—	23	37·3
Mean air temperature	—85	—	—	—	—	—	—	1	—	1	1·4
	85—89	—	—	—	—	1	4	2	—	7	11·3
	90—93	—	—	—	1	6	3	1	—	11	18·0
	94—98	2	5	5	3	8	1	—	—	24	38·7
	98	1	4	8	3	3	—	—	—	19	30·6

Part 2. Total Cases.

		—31	31—40	41—50	51—60	61—70	71—80	81—90	+90	Total	Percentage
Mean air temperature	—85	—	—	1	1	5	3	2	3	15	4·1
	85—89	—	—	—	—	6	11	13	1	31	8·7
	90—93	3	1	4	5	20	14	4	1	52	14·3
	94—98	12	27	26	29	64	16	1	—	175	48·2
	98	8	20	30	15	17	—	—	—	90	24·7
Percentage		6·3	13·2	16·8	13·8	30·0	12·1	5·5	1·4		
Mean air temperature	—85	—	—	2	2	4	7	10	60		
	85—89	—	—	—	—	5	25	65	20		
	90—93	13	2	7	10	18	31	20	20		
	94—98	52	56	42	58	58	37	5	—		
	98	35	42	49	30	15	—	—	—		

When the maximum temperature reaches 100° to 103° F. (37·7° to 39·4° C.) heat-stroke is not uncommonly fatal with a percentage of moisture between 60 and 70, but only three cases occurred with drier atmospheres of that degree of heat, while with the corresponding mean temperature of 90° to 98° F. (32·2° to 33·8° C.) only one case occurred with a degree of moisture below 61 per cent. When, however, the mean temperature reaches from 94° to 98° F. (34·4° to 36·6° C.), and the maximum from 104° to 108° F. (40° to 42·2° C.), then heat-stroke cases may occur with a drier atmosphere, although still most common with over 50 per cent. of

moisture. With yet higher temperatures of over 98° F. (36·6° C.) mean, or over 108° F. (42·2° C.) maximum, heat-stroke cases commonly occur with quite dry atmospheres, such as are indicated by 30 to 50 per cent. of moisture. Fortunately, such high temperatures, combined with a moist atmosphere, do not occur in places in India where European troops are stationed. Possibly they might be met with in the stoke-holds of ships in such very hot damp climates as that of the Red Sea, where so many cases of heat-stroke occur, and observations on the moisture, as well as the temperature, under such conditions would be of interest.

The second part of Table II., in the total number of 363 cases of heat-stroke in the British Army in India, shows exactly parallel results to those of the fatal cases just detailed. In only 4·1 per cent. was the mean temperature below 85° F. (29·4° C.), and in several of these the reading was due to a low minimum temperature produced by heavy rain or a dust-storm occurring after the attack had ensued, the maximum temperature at the time of the onset of the hyperpyrexia having been about blood-heat or higher. In 8·8 per cent. the mean temperature was from 85° to 89° F. (29·4° to 31·6° C.), almost every case occurring with a mean temperature under 90° F. (32·2° C.) being associated with an air moisture of over 60 per cent. In the remaining 87 per cent. of the cases the mean temperature was 90° F. (32·2° C.) or more, and the maximum one over blood-heat, while in 73 per cent. of the total cases the mean temperature was 94° F. (34·4° C.) or more, above or within a very few degrees of the body temperature, the continuance of which conditions, often for days together, must be a great trial to the cooling mechanism of the human system.

The last part of Table II., showing the percentage of cases occurring at different mean temperatures, classed under each 10° of moisture in the air, brings out well the importance of this last factor. Thus, with over 90 per cent. saturation, three out of five cases took place with a mean temperature of under 85° F. (29·4° C.). With from 81 to 90 per cent. of moisture three-fourths of the cases took place with a mean temperature not exceeding 89° F. (31·6° C.). On the other hand, with a moisture between 61 and 70, over 72 per cent. of the cases occurred at a mean temperature between 94° and 98° F. (34·4° to 36·6° C.), and with a moisture of only 40 to 50 just half the cases took place with a mean temperature of over 98° F. (36·6° C.). With still drier atmospheres the relative proportion at different temperatures remains about the same, as now the hyperpyrexia is no longer largely dependent on interference

with evaporation of sweat, but can be produced by such great heat without the aid of the latter factor.

The results of this study may be summed up by saying that when the degree of moisture in the air, as well as the actual temperature, is taken into consideration, the alleged capriciousness in the occurrence of heat-stroke cases entirely disappears, and their incidence is readily explained on purely physiological grounds, without the assistance of a hypothetical microbe. If a high degree of moisture is present, interfering with free evaporation of perspiration, then the hyperpyrexia of heat-stroke may ensue with a maximum air temperature of just about blood-heat, or a mean temperature of 10° F. (5·5° C.) lower. With a drier atmosphere, the body-cooling mechanism may fail when the maximum air temperature exceeds that of the body, and the mean temperature closely approaches it. A knowledge of these facts will allow of the occurrence of this dangerous affection being anticipated, and measures taken for the early detection and prompt treatment which alone will save the lives of the vast majority of the sufferers.

TABLE III.—HOUR OF ONSET.

	Cases	Percentage	Total
Noon to 4 p.m.	22	35·5	74·2 per cent.
4 p.m. to 8 p.m.	24	38·7	
8 p.m. to midnight	5	8·1	25·8 ,,
Midnight to 4 a.m.	0	0·0	
4 a.m. to 8 a.m.	7	11·3	
8 a.m. to noon	4	6·4	

Hour of Attack.—Table III. shows the time of admission of cases of heat-stroke to hospital, from which it appears that 74·2 per cent. were between the hours of 12 noon and 8 p.m., and 8 per cent. more between 8 p.m. and 12 midnight. On the other hand, only 11·3 per cent. occurred between midnight and 8 a.m. Moreover, some of the few cases admitted during the night were probably attacked earlier during the heat of the day, but treated at the barracks and only removed to the hospital in the cool of the evening. Thus in the Calcutta European Hospital I found that the hour of onset of the attack was between noon and 8 p.m. in twelve out of thirteen cases, and at 10 p.m. in the remaining one. Further, in no less than nine out of these thirteen cases the onset was between 3 p.m. and 5 p.m., precisely the most trying time of the twenty-four hours. The statement of the microbiologists that the majority of heat-stroke cases occur at night, when it is coolest, is thus untrue for India, and the close relationship between the onset and the

hottest part of the day is entirely in agreement with the simple physiological causation, and contrary to the newer parasitic theory.

Distribution of Heat-stroke in India.—The statements of the authors already referred to regarding the distribution of heat-stroke in India are not borne out by the British Army returns. Out of 425 cases on my lists (including some stations for which meteorological data were not available), only 11 occurred in the coast towns of Bombay and Madras, where full regiments are stationed, while cases are also rare in Calcutta among soldiers. Many cases do occur in the huge dry plains drained by the Indus and Ganges, but these are the hottest parts of India, and most remote in their climatic conditions from the moist low coastline of the Peninsula, while cases are very rare in Assam, which has a very damp but comparatively cool climate.

Elevation.—Still more strikingly incorrect are the statements that heat-stroke is unknown on the plateaux of India or above an elevation of 600 feet. A number of cases occurred in the last three years in the high plateau of Central India, and no less than 71 per cent. of the 425 cases were at places at an elevation of over 600 feet, while the disease is common at Rawal Pindi, and also occurred at five other stations at an elevation of over 1,500 feet, in which the temperature and moisture shown above to be associated with heat-stroke occur.

The Distribution of Heat-stroke in Relation to Heat-waves.—Lastly, to test the statement that the distribution of heat-stroke occurs independently of "the atmospheric temperature-curve," I have worked out the daily distribution for each station of all the cases (72 per cent. of the whole) occurring in the two hottest months of June and July, in relationship to the temperature and moisture conditions. The results show an extremely close relationship between the incidence of cases in stations of the same province, and waves of unusually high temperature, of which the following may be taken as typical examples :—

The year 1905 was exceptionally hot in India, and heat-stroke was correspondingly prevalent, from Calcutta, to Peshawar in the extreme north-west of the country, seventy-three cases having occurred in the last-mentioned station. All but one of these took place between June 24th and July 13th, during a spell of exceptionally hot weather. The mean air temperature during this period varied from 94° to 100° F. (34·4° to 37·7° C.), and the maximum was between 103° and 117° F. (39·4° to 47·2° C.), having reached 110° F. (43·3° C.), or over, on thirteen out of the twenty days. Further, the

largest number of cases occurred on those days when over 60 per cent. of moisture was present in the air, and the next largest number when it was between 50 and 60 per cent. Moreover, the complete and sudden cessation of this terrible outbreak occurred on the very day following a rapid fall of 11° in the mean and 17° in the maximum temperature, to reach a mean of 83° F. and a maximum of 90° F.; and no further cases were admitted during the last eighteen days of July. A more complete example of the very close relationship between a heat-wave and a severe outbreak of heat-stroke it would be difficult to imagine.

During the same heat-wave the affection was also very prevalent in the United Provinces of Agra and Oudh, and in Calcutta in Lower Bengal. An analysis of the returns for a number of military stations in the United Provinces shows a marked tendency for heat-stroke to occur in widely separated places on the very same days, which were also days of specially high temperature. For example, the hottest day of the year 1905 at Cawnpore (in the centre of this Province) was June 23, when the mean temperature was 101·7° F. (38·7° C.), and the maximum 110·5° F. (43·6° C.). On that very day twelve cases of heat-stroke, spread over six stations, occurred in the British Army in this Province, by far the largest number on a single day in the three years' records; truly a remarkable coincidence if they were all microbic in origin. Moreover, the decline of the cases was again a sudden one, and coincided with a marked fall in temperature.

Other similar instances might be given, but it will suffice to say that whenever heat-stroke was exceptionally prevalent in any province or station, unusually high temperatures were also registered. It may, then, be confidently asserted that throughout the varying climatic conditions of the great Indian Empire, there is a most intimate relationship between heat-waves, the degree of moisture in the air being also taken into consideration, and the prevalence of heat-stroke; and all the facts are readily explainable on the hypothesis that the hyperpyrexia is produced by a failure of the cooling mechanism of the body during exposure to great heat, especially if accompanied by much moisture in the air and of prolonged duration, the attacks being often strongly predisposed to by exhaustion or physical weakness due to any depressing illness.

Treatment and Prophylaxis.—Clinically, the most remarkable feature about heat-stroke is the frequency and rapidity of recovery from severe hyperpyrexia. In my Calcutta series, two out of three patients admitted with temperatures of 109° F. (42·7° C.), and two out of four with 108° F. (42·2° C.), got quite well under the usual

treatment with cold douches and iced baths; cold or iced water enemata being also of value. The exact degree of temperature of the patient was found to be of much less importance than the length of time unconsciousness had persisted before adequate treatment was adopted. Thus, the average period of such unconsciousness before admission was three hours and a half in the fatal cases, although the longest was but four hours and a half, while in those who recovered it averaged but one hour and a half, so that the prognosis depends entirely on the rapidity with which the condition is detected and appropriate remedies applied.

This fact has also great theoretical importance, for if the hyperpyrexia and loss of consciousness, coming on with such extreme rapidity as is the case in heat-stroke, be really due to a microbic infection, its toxins must be of an extraordinarily virulent nature. Are we to believe that the early application of cold to the surface of the body will almost immediately destroy such a toxin circulating in the blood of the patient? Is there any other example known of such serious toxic symptoms being thus easily and rapidly relieved? This difficulty alone appears to me to be fatal to the microbic origin of heat-stroke.

The matter, moreover, has great practical importance; for the knowledge of the exact meteorological conditions associated with heat-stroke which I have worked out will enable the likelihood of an occurrence of cases of the affection to be anticipated, and steps taken to ensure the first symptoms of its onset being detected at a stage when prompt treatment will certainly prevent death. Such knowledge will also greatly decrease the incidence of the serious and sometimes permanent injury which so often attends recovery from this dangerous condition of hyperpyrexia. In Calcutta invaluable time has often been lost in bringing patients to hospital instead of first applying cold on the spot to reduce the temperature, with the result that they only too often come under treatment when in a hopeless condition. In order to avoid such disasters, Port Health Officers should receive intimation of the occurrence of dangerous degrees of heat and moisture, and they should then issue printed instructions to the captains of all vessels in port, containing information as to the early detection and first treatment of any cases which may occur; while persons who appear in any way unwell should be carefully watched. Similar precautions should be taken in barracks, &c., during heat-stroke weather; for it is only by detecting and treating cases early that the death-rate from heat-stroke can be greatly reduced.

SMALL INCINERATORS.

By Lieutenant-Colonel H. A. HAINES.
Royal Army Medical Corps.

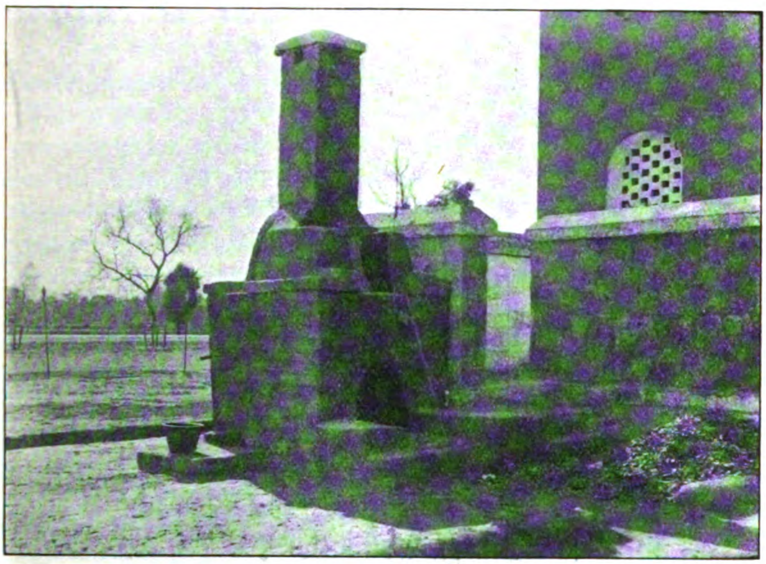
Since the record of my first modest attempt at the solution of the problem of sewage disposal in India, by means of small incinerators, appeared in the Journal of June, 1906, I have had some further experience with the system, which has confirmed me in my belief that for a very large number of cantonments in this country we have in it the best way out of a *burning* question, and that not only on the score of efficiency but also of economy, for out here we think in pice (¼d.). The manner in which English municipalities try experiments with sewage disposal would be regarded here as sheer lunacy.

While the principle remains the same, *i.e.*, the combustion of the night soil with the aid of the day rubbish previously removed as waste, thus doing away with the transport of either, yet the details have been found, as expected, capable of many improvements. As to the question of which type of incinerator is the best, I think the exact plan chosen is a matter of small importance; for instance, Surgeon-General Hamilton, I.M.S., found that a *chula*, or open fireplace, was quite sufficient to meet the needs of a private latrine.

Herewith is a photograph (p. 35) by Captain Maynard Crawford, R.A.M.C., of the latest incinerator put up in a section of the Ambala Station Hospital. It cost 8 rupees, or 10s. 8d., which ought to be considered cheap enough by the most ardent economist. The details of its construction may be of interest, so I give them briefly: The bricks used, numbering about 1,500, were collected from military works *débris*, old drains, &c.; they were built together simply with mud plaster by a dhooli bearer, who considered himself well rewarded by a "baksheesh" of 8 annas. The ironwork is the most expensive item, boiler and grating costing 7 rupees 8 annas; the latter is formed of bars 1 inch in diameter, and 22 inches in length, twelve of which are placed an inch apart in the interior about a foot and a half from the ground, their ends resting on two ledges—forming thus the floor of the charge space. The boiler, once a carbolic acid drum, was supplied with a lid and a discharge pipe at a cost of 1 rupee; it rests partly on the grating and is partly built into the wall. The

brick walls are on top carried on as a kind of dome, ending in the chimney about 6 feet high. In one side of the dome is an opening closable by a flap door made of sheet-iron hinged on the upper edge; this cost so little that the Military Works Department would not charge for it.

As may be seen in the photograph, the incinerator is built up against the back wall of the latrine, and the space around it is enclosed with a little mud wall of 6 inches just to keep the apparatus used all in one place; this space is "liped," or plastered

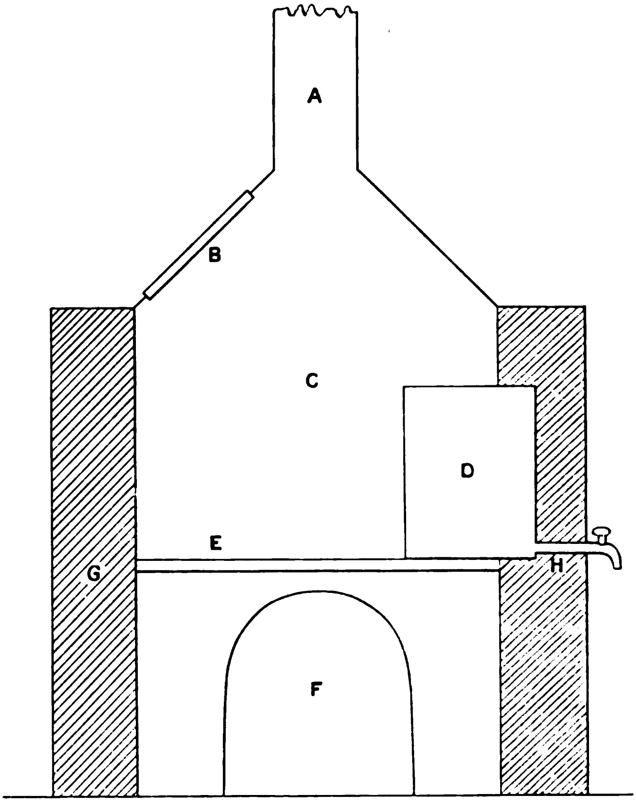


over, with a special mixture instead of the natives' ordinary cow-dung plaster, and this mixture is also used on all earthen floored latrines, urinals, &c. Its composition is as follows:—

One part crude kerosine oil plus 4 per cent. carbolic acid.
One part coal tar.
Four parts mud.

The carbolic acid (crude commercial variety) is readily miscible with the kerosine oil, and was found to be fatal to all fæcal microbes. The outside of the incinerator is "liped" the same way and may then be whitewashed. The *modus operandi* is as follows: The latrine *gumlah* or commode pan is first smeared with kerosine oil plus 4 per cent. carbolic acid, and then charged with sawdust to a

depth of 2 inches; this facilitates working and aids in combustion. When the vessel has been used the whole content is as a rule dry enough to allow of its being tipped straight into the charge chamber of the incinerator and is thus finished with. If, however, there is a quantity of liquid, the sweeper takes the vessel to the strainer,



SECTION DIAGRAM.

A, Chimney of stove pipe on iron dome, or of brick on brick arch; B, door for feeding charge; C, charge space; D, boiler; E, iron grating; F, arch doorway (does not require door if chimney is high enough for good draught); G, brick walls; H, discharge pipe with tap or plug of wood.

which is a simple tray with holes in it standing over a tub; this tray or sieve has a layer of leaves or dry rubbish in it 3 or 4 inches deep, and a very little mixing up with a bit of scrap iron is sufficient to render the charge fit for transfer to the incinerator; the liquid which has run through is then poured into the boiler. Urine

bottles are emptied direct into the boiler, thus avoiding the infection of any other vessel; bed-pan contents also go right into the incinerator without further handling; bottles and pans are then immediately washed in carbolic lotion. For enteric and other patients in bed this amount of handling of vessels appears to me to be the minimum.

The fire below the charge is started with 30 or 40 lb. of firewood and kept going with the sweepings of the compound, stable litter, &c., and when it is well under way it continues to burn, with little or no attention, for hours. The charge chamber never needs touching, the ash falling down of itself, and being seldom large in quantity. The boiler, having but a capacity of 12 gallons, has to be filled several times, but it boils in two hours. The ash and boiled liquid are easily disposed of in the garden.

The working expenses will naturally vary in different places, depending not alone on the cost of material, but also on the interest taken in it by the commanding officer. For 200 people with three small incinerators in different compounds the expenses were:—

Firewood: 45 maunds, at 3 maunds per rupee = 15 rupees.
Sawdust: 20 maunds, at 4 maunds per rupee = 5 rupees.
Repairs, say, 1 rupee per month.
Total 21 rupees, or £1 8s. per mensem, as a maximum.

Per contra saving every month:—
One rubbish cart at 16 rupees.
Three filth carts at 16 rupees = 48 rupees.
Boiling infectious excreta 16 rupees.
Repairs to this boiler, say, 2 rupees.
Bildar at trenching ground, provision and repairs to Crowley carts, 1 rupee per head per annum, say 16 rupees.
Total 98 rupees per mensem, showing balance saved in cash alone of 77 rupees.

The advantages of incineration are well known and need no advocate; they apply with more force in a country like this, where human nature seems so perverse that systems of any complexity appear to be foredoomed to failure. I may be therefore excused for mentioning some of the points which appeal forcibly for more recognition. The foremost advantage noticeable is that sterilisation is complete; the wily sweeper can practise no deception with ash: its presence is indisputable evidence, whereas sewage may or may not have been boiled. Anyone can inspect ashes, but to state that liquid sewage is sterile needs a bacteriologist. As regards boiling the separated liquid, there is, I admit, a loophole, as the

sweeper *may* throw it away without having boiled it; to see, however, that the boiler is full is the minimum of supervision, and the provision of an automatic mixer which would allow liquids to run direct into the boiler would completely baffle the *mehtar*, as then not to boil the liquor would entail on him considerable trouble, and in India the safest course is ever the line of least resistance; besides, the *mehtar* delights in the sweeping up of leaves and in squatting before a fire, he also has his little perquisite of firewood, and the proximity of the incinerator to the latrine obviates the undignified perambulation with *haltis* of filth.

This brings us to the second advantage, namely, the saving of all transport. Probably the water-borne transport of sewage is the best, but apart from its immense initial cost the fall necessary makes it often an engineering difficulty; there is also the scarcity of water in many stations, the upkeep of pipes, risks of leakage, fouling drinking water supplies, &c., and at the end of the pipe there is still the disposal in trenches or septic tanks, with all their possibilities as breeding-grounds for flies. The other means of transport on which we are unfortunately dependent in the majority of Indian stations is the Crowley cart, or "ironclad." To mention this abomination must be sufficient; its horrors are beyond my pen, its cost is enormous, and its efficiency as a fly-distributor unrivalled. The transport of sewage in India appears to be never likely to become more than a choice of evils, so that this advantage alone should justify the adoption of any system which secures the abolition of conveyance.

The third point is economy. Our population here is well over 50,000, and the annual budget for conservancy is 60,000 rupees, which sum will be increased this year. This immense amount could be reduced to one-fifth, as I have shown above, or possibly less, as the heat developed might be utilised for various purposes; *e.g.*, I propose trying to supply hot water to a wash-house during the winter months from the next incinerator.

Fourthly, assuming that some supervision will be necessary with whatever system is in use, I think here it is reduced to a minimum. Large incinerators, besides expense, mean transport; water-carriage and biological treatment still leave the sludge and effluent to be dealt with at the distal end; either of these installations means a large staff, but with a small incinerator at each latrine, or group of latrines, there is no need to increase the establishment of sweepers by even one man, and we get rid of the stuff at the latrine itself. Some minor advantages in having

an incinerator at hand in hospitals may be mentioned. Articles of food are frequently brought for inspection before sale; if they are unfit for consumption they are just popped into the fire and give no further opportunity for fraudulent practices. Infected dressings, lint, tow, &c., are burned *ek dam*. Servants' dirty rags, &c., disappear for ever; formerly worn-out shoes and clothes went on indefinitely.

The objections urged are not very serious, the most persistent objectors being flies; they dislike the smoke and the odour of kerosine oil, and they find so few vessels for laying eggs in. The poor fly is indeed rather badly defeated; as, if in spite of those deterrents she lays a batch of eggs in the latrine pan, they arrive not at maturity but ashes, and that within a few hours; the result is that very few winged insects are to be seen about, either in latrines or kitchens. A few prejudiced people, however—more intelligent perhaps also—sniff at the smoke; for instance, one excitable lady, discovering only after two months what was being burned, suddenly declared the "stench intolerable." About a week after this, becoming interested in some discussion, she walked with me right into the smoke and noticed nothing; I kept her standing there for a few minutes waiting for an outbreak, but it did not come; she had forgotten how "really terrible it was"! If there is any smell it can at once be stopped by throwing a few handfuls of dry rubbish on top of the charge; I have found this necessary only when the sweeper has been changed, the new stoker not being quite as sensitive to smells as English nostrils are.

A more reasonable objection is as to the disposal of the boiled fluids in the garden. The plan I adopt at present is to have several beds prepared, as if for flowers, with loosened earth. These are one yard by four yards in area and are used alternately; they absorb for weeks at a time, making a very rich manure. By standing on the windward side of these the odour of urine is discernible, but the most critical sanitarian must be doubtful of the harmfulness of this, even if he forgets the conditions of many a healthy camp, where the authorised urinals are 200 yards away from numbers of the men's tents, and a night visit entails the negotiation of ropes innumerable and various other pitfalls, besides the uncertainty of being able to find one's tent again. If he thinks unboiled urine is not plentiful around these tents, and that without apparent ill-result, then he is beyond argument, or else he is a descendant of the medical officer who recommended a new drainage scheme for a city temporarily occupied by an invading army!

I have been unable to get any flies hatched out of the earth on which the boiled urine has been poured, or in fact any form of insect life visible to the naked eye.

The fuel question looks at first a difficult one, but even if every scrap of it has to be purchased, it would be cheaper to do so than to continue the old primitive method. My first efforts at this means of sewage destruction having been in a hill station with a liberal store of brushwood available as fuel, I had, on trying it in the bare plains of the Punjab, some misgivings as to success, but I found that Nature was just as generous here: the profusion of leaves shed by the trees in an ordinary compound in India is marvellous, and the rotation in the order of the fall of the leaves from the different trees suits the demands of the incinerator remarkably. That the heat in one of these furnaces is not enough to boil the fluid in the boiler is an objection that may sometimes hold good, but it is only due to laziness on the part of the stoker. One of the first stokers here was so keen to burn up the sweepings that the heat generated one day nearly melted the iron bars; they collapsed and fell out, twisted up into S-shapes; operations had to be suspended for several days, as it took twenty-four hours for the building to cool off enough to allow a man to go inside to repair it.

For those desirous of improving their sanitation it is an encouragement to find a system that can be introduced as a tentative measure at a trifling cost; if it fails no great damage has been done, and if it succeeds it can be extended at will.

There are now about twenty of these small incinerators working in the Punjab, which means that I have written nearly the same number of specifications and directions for the commanding officers and medical officers concerned.

NOTE ON THE INVESTIGATION OF CATTLE DISEASE IN THE PROTECTORATE OF SIERRA LEONE.

By Captain F. HARVEY.
Royal Army Medical Corps.

The following brief notes on an investigation of cattle disease in Sierra Leone were made during a tour of service in that Protectorate.

Symptoms.—The chief symptoms of the disease in *cattle*, which appears to run its course in about six months, are: Wasting, especially noticeable in the hind-quarters and loins—in advanced cases the hindquarters sway and stagger as if not belonging to the animal. A watery discharge from the eyes, and in the latest stages opacity of the cornea. Sometimes there is a discharge from the sheath of the penis, accompanied by some œdema of that part. The coat has a rough and dull appearance. The animal is drowsy and apathetic, and appears to sleep much more than a healthy one. In the early morning the sick animal is not seen chewing the cud as are its fellows, but will, however, take food right up to the end. There is irregular fever, with increasing weakness accompanying the emaciation. Often there is a slight cough, with breathlessness.

The principal symptoms amongst infected *horses* are: enlarged cervical glands, lingering foot, hide-bound coat, tenderness of thorax and abdomen, occasional attacks of "red-water," and sometimes swelling of the abdomen. With our inoculated laboratory animals, such as goats, puppies, guinea-pigs, &c., the disease is usually fatal in about four weeks, all the symptoms being intensified.

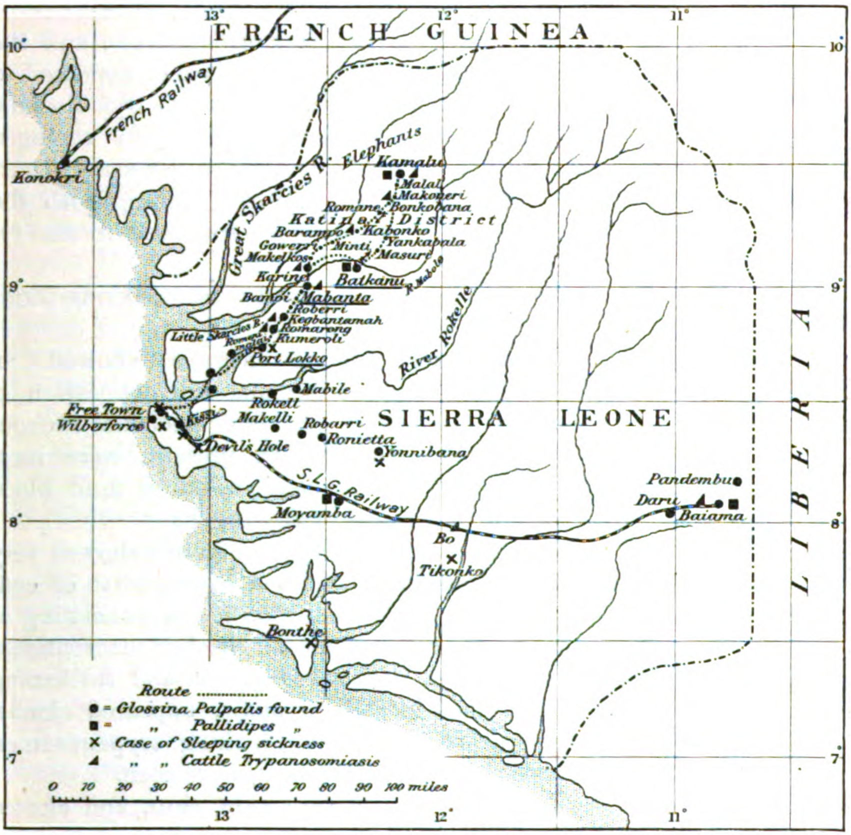
Mortality and Distribution.—This disease is apparently fatal to cattle, horses, dogs, goats, and probably to mules, sheep, and other domestic animals. With reference to the average annual mortality, if it can be accepted as a fact that every animal contracting this disease certainly dies within so many weeks or months, then, taking as an index the line traversed (see map), and totalling up the second, third, and fourth columns of the following table, it would appear to approximate to the high total of 33 per cent.

A feature of this disease is its marked intensity and endemicity at certain spots; this, however, will probably be found to correspond with the prevalence and distribution of the flies (*Glossina palpalis* and *pallidipes*), and the topography of the country (see spot-map). A complete survey of the disease would, I think, show that it is far and away the most important malady in connection with animals in this Colony and Protectorate.

Neighbourhood and village	Number of cattle examined	"Died" since last rains	"Sick," according to natives	Probably sickening	Remarks
Masuri	60	5	2	2	Fair-sized cattle.
Malal No. 1 ..	20	0	2	1	,, ,,
Kamalu (spent 5 days here searching for flies and examining blood films)	72	18	18	6	Cattle small and poor; trypanosomata found in two; and the fly (*Glossina pallidipes*). Puppy inoculated from sick bullock, January 16th, 1907.
Makoneri	25	2	0	2 or 3	Fair-sized cattle.
Bonkobana ..	60	3	0	Several	Large and healthy.
Romane	6	0	0	? 0	,, ,,
Kabonko	20	3	2	—	Magnificent cattle. Fine open grass fields.
Minti	2	15	2	0	Only 2 sick (dying) cattle left here out of 60 four years ago.
Gowrri	100	20	0	Several	Fair condition; fine, healthy site, but poor grass. Cattle well looked after, and belonging to chief Bramasanda. Only 3½ miles from Minti, where mortality was 100 per cent. Bramasanda states that he has lost 40 out of 200 since last year.
Makelkos	20	3	0	? 0	—
Karine	20	2	2	4	And two horses also examined—one dying and another sick. One other horse already died. Trypanosomata found in one horse.
Bamoi	14	6	0	2 or 3	—
Roberri	8	0	0	1	—
Kegbantamah ..	100	40	0	25	—
Romarong ..	6	0	0	0	Resting-place for cattle *en route* only.
Kumeroli	12	0	0	1	All fit, and fair size; plenty of calves.
Romeni	70	0	0	1	Medium size and fair condition.
Malal No. 2 ..	21 (40 in grass fields not seen)	0	0	10	All in very poor condition.
Port Lokko ..	20 *only* seen, but many more here; **656** was the total number examined	2	0	0	All in good condition and appear healthy.
Free Town (examination to be continued)					

Animal-Blood-sucking Insects.—Apart from mosquitoes, *G. palpalis* seems to be omnipresent. One has only to sit down on any sandbank of a river with fairly steep shaded sides, and these flies

will soon find one out. With regard to *G. pallidipes*, this species appears to be found only in the neighbourhood of cattle near water, and is scarcer. The Tabanidæ are also very common where cattle are, and they are very vicious, biting people when they get the chance. Stomoxys likewise are very plentiful. Ticks are everywhere.



Map showing route taken and places where cattle were examined. Total mileage covered estimated at 300 miles; time occupied, twenty-four days. From Free Town to Port Lokko by canoes. Military stations are underlined.

The Trypanosome.—Average size, including flagellum, 15 μ to 18 μ long, by 2 μ to 3 μ broad; but considerable variations occur. Actively motile, moving flagellum foremost or sideways, progressing by means of a rotatory lashing movement. Contains a macronucleus which is generally oval and longitudinally placed, and a distinct rounded centrosome. The undulating membrane, generally

speaking, is not well developed and is difficult to make out. The flagellum, which is short, has never been observed reaching the centrosome, but stops short at the not infrequent vacuole which is placed between it and the centrosome. Scattered chromatin granules are often seen round the macronucleus, and in some instances projecting knobs of chromatin.

In the blood of a laboratory puppy, forms showing a small round, compact—or if oval, longitudinally placed—macronucleus, long thin body (in some instances almost spirillum-like), and the absence of any distinguishable undulating membrane, appeared to correspond with what have been described as the male trypanosome type. Other forms, short, fat and blunt, with loosely arranged chromatin of the macronucleus, not infrequently transversely placed and showing three or four rings or loops, corresponding with the bi- or tri-partite division of the centrosome, answered to the so-called female type.

In addition, a few tadpole, pear-shaped, and occasional ring-forms were found.

Post-mortems on laboratory animals always showed an excess of serous fluids, often some adhesions and congestion at the bases of the lungs. No erosions of gastric cr duodenal mucous membranes noted. Enlarged glands, when present, were most marked in the cervical region. Deep claret-coloured fluid blood in the heart. No special enlargements of any organs.

Microscopical section of enlarged lymphatic glands showed very marked proliferation of endothelial nuclei and over-growth of connective tissue, also little heaps of degeneration forms, consisting of nuclei and granular *débris* of trypanosomes. Neither macrophages nor erythrocytes were observed, nor any very marked thickening of capsular layer. Heart muscle stained badly, appeared cloudy, and showed coiled masses of degenerated-looking trypanosomes, when longitudinal sections of the small vessels were seen.

The blood in the later stages was very pale, thin, and clotted badly. There was a great increase of mononuclears, some increase in eosinophiles, also polychromatophilia and auto-agglutination. The trypanosomes sometimes showed a considerable decrease in the circulating blood, but shortly before death, as in the case of a puppy, where apparently the maximum virulence had been reached, they almost numbered as many as the red cells themselves. They did not, however, in their numbers, appear to bear any definite relation either to the temperature chart or to the intensity of the disease.

FURTHER NOTES ON SURGICAL TECHNIQUE.

By Major F. E. GUNTER.
Royal Army Medical Corps.

In a former number of the Journal[1] were published some notes I made at the Military Hospital, Curragh Camp, on surgical technique and experiments in connection therewith. Since then I have made further experiments and have modified my methods accordingly.

A Septic Gauze from a Freshly Opened Packet.—This was sterile when grown aerobically, but an anaerobic cultivation yielded a growth after four days. A rod-shaped bacillus, staining by Gram and basic dyes, was isolated. Realising the ease with which sterile aseptic dressings can become contaminated, I now have each portion of a dressing sterilised in separate tins for each case both in the theatre and in the ward. Almost any tins will answer the purpose. For the gauze I use cigarette tins, and for wool I have had tins of a suitable size made by a local tinsmith. The tins are sterilised in the autoclave. The dressings are not removed from the tins till actually required for use. To test the efficacy of this "tin sterilisation," some wool soaked in an anaerobic culture was placed in the centre of a roll of aseptic wool and the whole packed tightly into a tin and the lid lightly closed. It was then autoclaved for twenty minutes. The centre piece of wool was removed and an anaerobic broth culture made. This was found to be sterile after four days. This proves that "tin sterilisation" is safe. The only point is to have the lid of the tin loose during sterilisation and to close it tightly afterwards till required for use.

Haegler writes: "The proposition that all the germs on our hands, even those in the excretory ducts of the glands, come from *without*, is a saying which should properly never be given voice to now." From tests with sutures (*vide* former article), I have become convinced that the infection of sutures may come from these ducts and glands and not from the surface. Haegler made experiments with a culture of *Staphylococcus albus*. He rubbed this into an amputated finger and recovered it from the ducts of the sweat glands, but not deeper.

Working somewhat on these lines, I made the experiments

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[1] February, 1907.

subjoined. Sections were cut of the different layers of skin on an amputated finger and an amputated leg, and broth cultures made.

Experiment I.—Amputated finger.

First Layer of Skin.—*Aerobic* broth culture, sterile after seven days. *Anaerobic* broth culture, slight growth after seven days; a rod-shaped spore-forming bacillus, staining by Gram, isolated.

Second Layer.—*Aerobic* broth culture, growth after five days; a spore-forming bacillus, in pairs, staining by Gram, isolated. *Anaerobic* broth culture, growth in forty-eight hours; an oval, spore-forming bacillus, in pairs, staining by Gram, isolated.

Third Layer.—*Aerobic* broth culture, growth after five days; a rod-shaped bacillus, with rounded ends, in pairs, end to end, staining by Gram. *Subtilis?* *Anaerobic* broth culture, growth in forty-eight hours. *Subtilis?*

Fourth Layer, next connective tissue. *Aerobic* broth culture, growth in forty-eight hours. *S. albus* isolated. This layer was not examined anaerobically.

Experiment II.—Amputated leg (embolic gangrene).

First Layer of Skin.—*Aerobic* broth culture, growth in four days, probably *subtilis.*

Second Layer.—*Aerobic,* growth after days, probably *subtilis.*

Third Layer.—Next connective tissue, no growth after five days, either aerobically or anaerobically.

These experiments are too few in number and too roughly performed to be conclusive, but they rather point to the fact that the deeper layers of the skin are normally infected. For this reason I have modified my form of suture. It seems to me that if you pass a suture through the whole thickness of the skin you are making a path for micro-organisms into the uninfected connective tissue beneath. I therefore now pass my sutures down to the middle layer of the skin, then across to a corresponding point opposite, and then out (fig. 1). Practically, I find this a great advantage. If it does nothing else it brings the edges more accurately together and there is less chance of inversion.

Dishes.—All glass dishes have now been abolished from the theatre and ward. These dishes cannot be boiled and so are unsafe. I am now using enamelled iron bowls, which are boiled before use. Water at commencement of operation taken from glass dish yielded a growth in three days when grown anaerobically on broth. Water from enamelled iron dish (used for dipping hands into during operation) gave no growths on broth after four days, either aerobically or anaerobically.

Water.—Water is boiled in the ordinary kitchen boiler with brass tap, as found in hospital cook-houses, and allowed to cool to the required temperature. The tap was at first regarded with suspicion, but the water has been tested two or three times and found to be sterile. For dipping the hands during the operation nothing but sterile water is used. This water has been tested at the end of operation on two occasions (one operation was for hernia, the other for removal of fatty tumour of thigh); in each case it proved to be sterile.

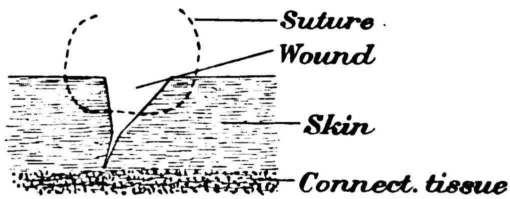


Fig. 1.

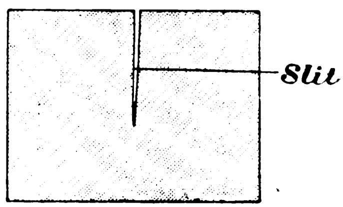


Fig. 2.

The result is satisfactory. Haegler, after testing water in a similar way, says, "I was horrified to find that a primarily sterile lotion was very markedly contaminated by the hands having been once washed in it during an operation." This is, I think, not at all surprising, as he does not wear gloves during an operation. If, as is almost certain, infection comes from the deeper layers of the skin, and if organisms work out to the surface in a very short time, it is easy to see how the water became contaminated.

Guarding the Operation Area.—At one time I used a gauze guard, but this is clumsy. I now work with linen. For a hernia I use a small square with a slit up one side (fig. 2).

The edges of the slit are fastened to the connective tissue after the skin incision has been made. The simplest way to do this is to allow the forceps, which have been used for catching bleeding points, to fall on the guard. This weight will keep it in position. To test the efficiency of the guard the following experiments were made :—

Experiment 1.—After the operation (for varicocele) both surfaces of the guard were rubbed over an agar plate. Over fifty colonies appeared after forty-eight hours' incubation. *S. albus* isolated. No *aureus*. The patient's skin was in a somewhat irritable condition.

Experiment 2.—From another case of varicocele. Upper surface of guard only rubbed on plate. Four colonies in forty-eight hours. It was thought that possibly infection might be due to soaking through of blood contaminated by micro-organisms, so, in order to determine source of contamination.

Experiment 3 was made. The operation was for removal of fatty tumour of thigh. The guard was adjusted as usual, but a layer of sterile gauze was placed between the guard and the skin. The upper surface of the guard and the skin surface of the gauze were tested as before. Upper surface of guard, four colonies in four days; *S. albus* isolated. Skin surface of gauze sterile after four days, proving that in this case the skin was sterile and that contamination came from elsewhere. It should be noted, however, that the gauze was not in contact with the edges of the skin.

Experiment 4.—Operation, removal of internal articular cartilage of knee. Upper surface of guard, one colony after forty-eight hours (not examined). Lower surface, sterile after three days.

Experiment 5.—Operation, inguinal hernia. Upper surface of guard, ten colonies after three days. *S. aureus* isolated. Lower surface of guard sterile after five days.

Conclusions from the Above Experiments.

(1) That the skin of the operation area can be rendered sufficiently sterile and kept so during an operation by means of a guard.

(2) That the guard has its uses in preventing the skin from becoming contaminated. The object of keeping the skin from contamination is to prevent it infecting the stitches.

(3) If the skin is in an absolutely sterile condition the use of a guard is unnecessary, but if the skin is irritable, as in Experiment 1, it is desirable to have a guard, as fingers, instruments, &c., can

easily be cantaminated by contact with the skin. The guard causes very little extra trouble, and I am inclined to continue its use.

It may be well to give a summary of the methods now in use here. They have been simplified since the publication of my former article, and in this hospital have proved reliable.

The night before the operation, the operation area is washed with soap and water, and *gently* scrubbed with a nail-brush for a few minutes. Too much scrubbing is, I am convinced, bad, as it tends to irritate the skin. The skin is then dried with a rough, sterile towel. Methylated spirit is then lightly rubbed over the skin and removed with sterile water; after drying, aseptic gauze is applied for the night. On the morning of the operation I wash my hands carefully, in fairly hot water, while the patient is being anæsthetised, dry them and then dip them in methylated spirit. The operation area is then washed with ether, soap, and methylated spirit. A sheet with a slit in it (to expose operation area) is applied as an overall for the patient. I then put on gown, gloves, and sleeves. The skin incision is then made right down to the connective tissue, bleeding controlled, and the guard applied. In making the incision I do not touch the skin with my hands, and the knife is discarded and not again used unless reboiled.

All instruments without exception are boiled and placed on sterilised towels, ready for use. Knives and forceps are occasionally wiped by an orderly. He never, of course, touches any instrument with his hands. Silk and silkworm gut are sterilised in test tubes which are not opened till required for use. (The plug is removed with forceps by an orderly and I remove the silks from the tube with a pair of dressing forceps as required; the tube is then closed by the orderly.)

All dressings are kept in the special tins till required for use. For sponges, gauze swabs are used. These are prepared on the previous day and fitted on to extemporised handles of suitable length made of twisted wire. They are then sterilised in jugs plugged with cotton wool. The plug is not removed till a swab is required. No antiseptic is used at any time with the exception of alcohol, and I am beginning to doubt if even this is really necessary.

The methods are so simple that I find orderlies pick them up at once. All one has to do is to impress on them that everything that cannot be or has not been sterilised by heat is to be looked upon as a source of danger, and they grasp the idea at once.

All these methods are applicable to septic wounds and injuries.

To septic cases, I think they certainly are; any attempt to kill septic organisms by chemicals must destroy the tissues. In the septic ward here freshly boiled gloves are used for each case, and every case has his separate "tin sterilised" dressings. Thus the risk of conveying infection from one case to another is reduced to a minimum. In dirty wounds, such as bad compound fractures, the case is, perhaps, different. Here you may be dealing with a gross infection in which the number of organisms is too great for the patient to deal with, and you may be justified in using chemicals, but you must be doing so at the risk of damaging the tissues and lessening the power of resistance. Personally, I do as little disinfection as possible.

Can these methods be worked in small hospitals without special appliances? Undoubtedly, they can. In most stations there is a disinfector. I have made experiments with "disinfector sterilisation" and find it perfectly satisfactory. The only point to remember is that the cold air inlet must be plugged with wool to act as a filter, otherwise the inrushing air, which may be contaminated, will infect the dressings. "Tin" and "test-tube" sterilisation can also be done quite well in Schimmelbusch's steriliser. (The only objection to it is that it is rather small.) Failing this, an ordinary cooking "steamer" will answer the purpose. The dressings should, however, be loosely packed as the pressure is low.

PLAGUE.

By Lieutenant-Colonel C. BIRT.
Royal Army Medical Corps.

A disease which has caused over five and a quarter million deaths of our fellow subjects in the last twelve years, may well merit attention and call for long and laborious research. The Reports of the Plague Commission under the able presidency of Major G. Lamb, I.M.S., issued as extra numbers of the *Journal of Hygiene*, September, 1906, and July, 1907, show with what thoroughness this work has been undertaken. The ability and ingenuity displayed in their investigations afford a valuable guide to others engaged in similar inquiries. These papers take a foremost place in the literature of the subject.

Plague is caused by the *Bacillus pestis*. This micro-organism is found in the buboes, blood, spleen, and other organs of sufferers from this malady. Unfortunate laboratory infections have given the final proof of its pathogenic action on man.

How does this bacillus gain access to the body? If we disregard that rarer form of plague—the pneumonic—in which the microbes are disseminated in the spray thrown off by the patients in the acts of speaking, coughing, &c., we will consider the more frequent bubonic variety. Now in some 70 per cent. of such cases the first bubo to appear is in the groin. Experiments show the significance of this. After inoculation of the lower animals the primary bubo develops in that group of glands which are in direct lymphatic connection with the area infected. We infer, therefore, that in 70 per cent. of bubonic plague victims the *B. pestis* has gained entrance in some part of the lower extremity. It will probably immediately occur to us that the most obvious mode would be through some slight abrasion or cut of the skin, which might become contaminated by dust or soil. But here experiment corrects us. The *B. pestis* is a delicate organism. It has never been isolated from the dust of floors of houses where plague has occurred. Floors of cow-dung—the usual material in the dwellings of Indian natives—grossly infected with plague cultures remain infective to animals allowed to run over them for twelve hours only. If sand and lime cement (*chunam*) is the paving material six hours is the limit. Moreover, plague houses which have been disinfected with a 1 in 750 acid solution of

mercuric chloride, which is sufficient to destroy the germs in the dust, soil, &c., are still infective, on one condition. That condition is—the presence of fleas. So far, then, we are in a position to state that plague is due to a bacillus which usually enters the body through the skin of the lower extremities, but not in the soil or dust contamination of slight injuries.

That outbreaks of plague have been associated with mortality among rats has been an observation of great antiquity which has been fully confirmed by almost universal experience. Now, animals placed in plague-houses, or in contact with plague-infected rodents, eating food contaminated with the dejecta of the diseased animals, remain healthy if fleas are absent. When fleas are present, plague appears among them, even if the healthy animals are protected from direct contact with the infected, and from contaminated soil. Aerial infection is excluded; for if two healthy animals are placed in an infected area, one protected from fleas by surrounding its cage with a 6 inch zone of "tangle-foot," and the other not so guarded, the latter will develop plague while the former will not. This therefore, is *a priori* evidence that fleas are the agents in transmitting the disease. But there is also direct evidence.

Pulex cheopis is the commonest rat-flea throughout the world except in Northern and Central Europe. Hence it would appear that the propagation of plague amongst rats is mainly due to this parasite. Experience has confirmed this supposition. Healthy rats living in flea-proof cages have contracted plague after receiving fleas (*P. cheopis*) collected from rats dying of plague in another cage. This demonstrates that the rat-flea, *P. cheopis*, can carry plague from rat to rat. We ask: Is this the most frequent mode of infection in nature? for it seems possible that the microbe might be conveyed in food. Indeed, it can be shown that it is possible to infect rats by feeding them with the viscera of dead plague rats. But there is this marked difference in the disease which arises. In the case of rats infected by feeding, the primary bubo is in the mesentery. In the naturally-infected rat, the primary bubo is in the neck, never in the mesentery. This implies a skin infection, as was noted above. Again, in rats infected by feeding there are found changes in the intestine, while in the naturally-infected rodents the alimentary canal is normal. The logical conclusion follows, therefore, that fleas are Nature's means of carrying plague from rat to rat.

By what method does the flea convey the micro-organism? The blood of plague rats may contain one hundred million bacilli per

cubic centimetre. The average capacity of the stomach of a rat flea is 0·5 c.mm. Therefore, a flea drawing blood from a plague rat may receive 50,000 plague bacilli into its stomach, in which their multiplication takes place. Rat fleas may remain infective for fifteen days. The excrement of fleas caught on plague rats contains plague bacilli. Fleas defæcate while sucking blood. A flea-bite affords sufficient avenue for inoculation if infective material is spread over the area. Plague bacilli have not been found in the salivary glands of the flea. The corollary to be drawn from these facts is, that the rubbing or scratching of the skin consequent on the irritation produced by the flea-bite is the probable means of inoculating the body with the plague bacilli in the fæces of the flea.

Though it must now be admitted that the flea is the carrier of the microbe from rat to rat, yet it may not be so readily conceded that the rat flea conveys the plague bacillus to man. To overcome this objection it must first be shown that the rat-flea, *P. cheopis*, attacks man. Experiment proves that the rat-flea readily bites human beings, even in the presence of its natural host, and that it can be kept nourished on man for three weeks. Fleas rapidly forsake their dead host. *P. cheopis* in considerable numbers (*e.g.*, forty-four after one minute's exposure) have been caught on the legs of men who have entered plague houses, or buildings where rats were lying dying or dead.

In order to pursue this line of research it is desirable to have at our disposal a trap for rat-fleas other than the bare legs of human beings. Liston discovered in guinea-pigs such a means of investigation. Guinea-pigs do not harbour fleas, but so keen are fleas to escape from the bodies of rats which are dead that they readily take refuge in the fur of guinea-pigs. Therefore, by allowing guinea-pigs to run loose in plague-infected houses, it has been ascertained that *P. cheopis* capable of originating the disease is always present. The fugitive rat-fleas seek the regions of the head and neck of the guinea-pig. The guinea-pig dies of plague. A bubo is found in the neck indicative of the cutaneous inoculation of that part which the fleas infest in greatest numbers. It is of great interest to note that even if the plague-stricken house has been disinfected, numerous rat-fleas can thus be trapped by guinea-pigs, some of which will succumb to plague contracted by the bite of the fleas to which they have given refuge. The cervical bubo in every case marks distinctly the avenue of infection. A census of rat-fleas captured by guinea-pigs has shown that *P. cheopis* is twelve times more numerous in plague houses than in dwellings where no cases have occurred.

We ask, If the rat-flea really transmits plague to man, why was it that the men who were first employed as flea-traps were not smitten with the disease? To this question, which is of great importance, the reply is, everyone engaged by the Commission was immunised by means of Haffkine's prophylactic; *i.e.*, by the subcutaneous inoculation of killed cultures of the plague bacillus. The members of the Commission, though occupied daily in what would have been otherwise most perilous experiments, carried on their investigations with the utmost confidence in the immunity thus acquired.

There might still appear to be a gap in our story. For how are to be explained plague ravages in those countries where *P. cheopis* is not the common rat flea? *Ceratophyllus fasciatus* is the flea which takes its place. Tests made to transmit plague from animal to animal by *C. fasciatus* have been successful. But there is also another possibility of conveyance which might account for the epidemics in England in the Middle Ages. The plague bacillus has been isolated from the blood of more than one-half of the fatal cases in men. In certain experiments to carry the infection from animal to animal by means of human fleas (*P. irritans*), in the stomach of which multiplication of bacilli occurs, success has been attained. Moreover, *P. irritans* also bites rats. Further researches, however, with fleas and other parasites caught on plague victims are desirable. Herzog found *B. pestis* in three *Pediculi capitis* taken from a child who died of plague. Skinner has suggested that ticks may not escape suspicion.

Enough has been said to show the vital importance of a knowledge of the life history and habits of fleas. Aristophanes held up Socrates to ridicule by attributing to him the endeavour to measure the leap of a flea. Even such an apparently trivial fact may have a profound bearing on the health of mankind.

At all seasons of the year the female flea lays eight to ten eggs at a time, which usually fall to the ground, though larvæ have been found beneath the crusts of uncleanly psoriasis patients. A footless larva is hatched in from six to eight days by its breaking through the egg-shell with a piercer. It lives on decaying, dead and dry animal matter. In twelve or fourteen days' time in summer, or longer in winter, the larva spins a silken cocoon within which it develops into a pupa. This inactive pupal stage lasts ten to sixteen days in hot weather, but may continue throughout the winter. The mature flea then escapes through the pupal skin and takes up its predatory mode of existence. It is thus seen that the flea

can reach maturity in one month. They may live long. One is recorded to have survived twenty-three months spent in captivity. They are occasional parasites only. Amongst other places they have been found in the nests of humble bees. Dry dust is essential for their propagation. Fleas were said not to flourish formerly in Central Africa, but they have now become common. Several villages on the shore of Lake Victoria were deserted in 1892 owing to a plague of these insects. Dr. R. A. Freeman visited Bontuku in 1888 and found the dak-bungalow swarming with these pests, which had been introduced by previous travellers from the coast. He says: "A dense cloud of black specks appeared on my white clothes and advanced upwards, so that I was compelled to brush them off every minute to prevent them swarming on my head and neck." He overcame their assaults by keeping the floors constantly flooded with water. In a few days hardly any fleas were to be seen. The Plague Commission noted that if the earth on their trays became wetted the fleas rapidly died out. Dry earth and sand were essential for their survival. This seems to be an important fact in the study of the epidemiology of plague. In the tables given by Lieutenant-Colonel Bruce Skinner in the *British Medical Journal*, vol. ii, 1905, showing the relation of deaths from plague to rainfall in Lahore, Bombay, and Calcutta, it is seen that when rainfall was greatest, deaths were at a minimum. Hankin states that fleas decrease in number on dogs during the hot weather at Agra. But here again the hot months, June to September inclusive, are also the rainy months. Another fact observed by the Commission which helps to explain the seasonal prevalence of plague, is that fleas remain infective only seven days in the non-epidemic season, but fifteen days in the epidemic. Moreover, multiplication of plague bacilli in the stomach of fleas has been shown to occur with six times greater frequency in the epidemic than in the non-epidemic season.

Now it has been proved that the dose, *i.e.*, the number of bacilli introduced, is an important factor in the propagation of plague. Thus in sixty-seven experiments to show whether a single rat-flea taken from a plague rat was capable of infecting a healthy animal, success was attained once only. Rats fed on nutriment soaked in human plague urine do not contract the disease on account of the small number of bacilli contained in it. More rats are immune to smaller doses of plague culture than to larger. Death occurs earlier after the greater doses.

It is imperative to be able to recognise a plague rat cadaver.

A naked eye examination by a competent observer is superior to a microscopic examination alone and may give reliable information even if putrefaction has begun. The presence of a bubo, usually in the neck, is of the first importance. Of little less significance is a peculiar mottled, or granular, fatty appearance of the liver. Abundant clear pleural effusion is a characteristic sign. Hæmorrhages in various parts of the body are common. It is unusual to meet with any disease in rats the *post-mortem* appearances of which are liable to be mistaken for plague. For microscopic examination smears of the bubo, spleen and heart's blood are stained with carbol-thionin blue. Involution forms in the bubos are frequent and aid diagnosis. Cultures are made from the bubo, spleen and heart's blood in oil broth for stalactitic growth, on salt agar for involution forms, and on ordinary agar. Subcultures, if *B. pestis*, produce acid without gas in mannite, maltose, glucose and levulose broths, but no change in lactose, cane sugar or dulcite media. Where putrefaction is far advanced the inoculation test is essential. This is performed by the dry and rough shaving of 1 inch square of a guinea-pig's abdomen, so that a slightly bleeding surface is exposed, into which the material to be inoculated is rubbed. Cutaneous irritation is observed in about twelve hours if the plague bacillus is present, and twenty-four hours later the inguinal glands are enlarged. If the dose of virus inoculated has been large the animal dies in about five days, if small, the disease may pursue a protracted course and the bubos may not be palpable until after several days.

Plague may appear in rats as a chronic infection giving rise to nodules or abscesses in the spleen, mesentery and lymph glands. Virulent plague bacilli are present in these lesions. It is a seductive hypothesis to assume that these plague carriers are the means of bridging over the intervals between epidemics; but of this, as yet, there is no conclusive experimental evidence. Furthermore, rats suffering from acute plague are caught in Bombay in the non-epidemic season. We are thus driven to the conclusion that it is the decrease in the number of the fleas during the time of year when plague no longer prevails, which is the cause of the decline of the epidemic amongst men.

It has been seen that the larger the dose of the plague bacilli injected into animals, the greater is the certainty of a general infection. The more fleas that bite a man—that is, the introduction of a larger dose of bacilli—the greater chance there is of his contracting plague. For it seems certain that there exists in man

as in animals, a certain minimal dose of *B. pestis* necessary to originate plague. The bacilli, if introduced in numbers below this minimum, no longer excite the disease. The defensive mechanisms of the body at the site of inoculation are competent to overcome the few plague germs introduced.

For the prevention of plague it is incumbent to carry on a war of extermination not only against rats but against fleas. It has long been known that greasy substances, mineral, animal or vegetable, instantly destroy the mature parasites. Hungarian shepherds from time immemorial have been accustomed to anoint themselves and their clothing with hog's lard to ward off the attacks of fleas. Ordinary germicides, such as 1 in 1,000 mercuric chloride, 1 in 100 of permanganate of potash, 1 in 40 formalin, 1 in 100 washing soda, lime water, are powerless. An emulsion of "phenyle" and petrol in 800 parts of water appears to be the method of most practical worth devised up to the present.

A question arises whether it might not be possible to originate some epizootic amongst fleas themselves which would compass their destruction. The study of the diseases of fleas would seem to offer a prolific field for investigation hitherto unexplored.

THE USES OF ADRENALIN IN OPHTHALMIC SURGERY.

By Captain A. J. HULL.
Royal Army Medical Corps.

In an age of therapeutic cynicism it is refreshing to turn to a drug, the physiological and therapeutical action of which is at once apparent. Being the most powerful vaso-constrictor in use, adrenalin is frequently used for the purpose of obtaining a bloodless field for operation. Adrenalin, however, possesses even more valuable therapeutic properties, and is also of considerable value as a diagnostic agent.

As a therapeutic agent adrenalin owes its importance to its property of acting as a powerful vaso-constrictor and hence reducing secretions, reducing the amount of the aqueous humour secreted, and reducing the intraocular tension. Knowing the action of adrenalin, upon the capillaries and the lymphatics it is possible to discover many affections of the eye in which adrenalin will be of service. Many diseases of the conjunctiva are benefited by its use. In any disease in which conjunctival hyperæmia is a prominent feature the instillation of adrenalin is worthy of trial. In purulent ophthalmia and ophthalmia of gonorrhœal origin, the instillation of adrenalin, may be with advantage combined with the other methods of treatment employed.[1] Catarrhal and granular conjunctivitis are decidedly benefited by the addition of adrenalin to the usual methods of treatment. The preliminary instillation of adrenalin whilst relieving the pain increases the efficacy of such reagents as protargol, silver nitrate, copper sulphate, zinc sulphate, and cyanide of mercury. In the case of ulcers of the cornea adrenalin is not as a rule indicated, but in the majority of cases of non-suppurative keratitis it may be employed with advantage. The treatment of interstitial keratitis is rendered more satisfactory by the addition of adrenalin to the solution of atropine used for dilating the pupil. It will be remembered how difficult it is in these cases to obtain a reaction to atropine, and how, as a result, posterior synechiæ are often formed. The difficulty is due to the condition of the cornea, which impedes the absorption of the atropine. Adrenalin is of distinct value in the treatment of iritis and irido-cyclitis, both on account of its antiphlogistic properties

[1] A. J. Hull, Journal of the Royal Army Medical Corps, December, 1904.

and on account of the increased dilatation of the iris. Although atropine is a remedy which it is customary to find used in almost all cases of inflammation of the eye, its influence upon such cases is more than doubtful, and it would be more scientific to limit the use of atropine to those cases in which the formation of posterior synechiæ is feared. Adrenalin may well replace the use of atropine in many cases of hyperæmia.

Adrenalin as a Diagnostic Agent.—The differential diagnosis between iritis and simple conjunctivitis is one of the most recurring questions in medicine, and simple as the question may appear, the prescriptions of many practitioners always contain atropine whatever the eye may be affected with. The most valuable distinction between the two conditions is the violet haze around the limbus seen in iritis, which is due to congestion of the deep ciliary vessels. If a good deal of superficial congestion be present (congestion of the conjunctival vessels), it may be somewhat difficult to distinguish the violet haze. The use of adrenalin will make the case clear. Upon instilling a few minims of a 1 in 10,000 solution of adrenalin the conjunctival vessels disappear, leaving a perfectly white conjunctiva, and if iritis is present the violet haze of the deep vessels will be distinctly seen; later, the adrenalin will have had time to act upon the ciliary vessels, and these also will disappear. In this way an early and certain diagnosis of iritis can always be made and the difficulties attending the formation of posterior synechiæ avoided by an early dilatation of the pupil. In a similar manner the diagnosis of diseases of the sclera and conjunctiva are simplified; trachoma granules in a violently inflamed eye will be easily brought into view; patches of episcleritis which would otherwise be overlooked become visible.

The Use of Adrenalin in Operations upon the Eye.—The question has been raised as to the necessity of using adrenalin when performing eye operations. Its use gives a bloodless field for operation and absolute anæsthesia. Against this it is urged that secondary hæmorrhage is apt to occur as a result of a reaction when the influence of the drug has passed off; moreover, it is argued that its employment is unnecessary, that operations have hitherto been performed without its use with equally good results. These objections cannot be considered to apply to operations upon the annexa bulbi. With regard to operations on the eyeball, the danger of hæmorrhage into the anterior chamber after the operation exists, and some surgeons appear to have been unfortunate as regards this accident. By continuing the instillation of adrenalin after

the operation in decreasing doses, the danger of reaction is obviated. Apart from the convenience of a bloodless field the complete anæsthesia obtained is in itself an advantage; although it is urged that this is obtained with cocaine alone, it will be found that several text-books mention the sensitiveness of the iris when the eye is cocainised, and point out the danger of the patient flinching when the iris is grasped.

Darier quoted the following experiment in support of his opinion that the administration of adrenalin at the beginning of an iritis may prevent the occurrence of cyclitis: "By means of a stick of silver nitrate we cauterise the border of the cornea. This violent chemical irritation provokes an intense hyperæmia of the ciliary processes, which quickly betrays itself by an abundant albuminous transudation into the anterior chamber. This reaction of the ciliary body can be prevented by injecting ½ to 1 milligramme of adrenalin." Taking advantage of this property the writer has employed the drug in a considerable series of operations on the globe, with the result that the eyes have quieted down more quickly than in the cases in which adrenalin has not been employed, and that any tendency to irritation from the retention of cortical matter in cataract operations has been avoided.

Methods of Application.—In the case of operations, the eye having been cocainised for ten minutes with a 5 per cent. solution of cocaine, either an ophthalmic tabloid of hemisine is placed under the eyelid, or one or two drops of a 1 in 3,000 solution of adrenalin hydrochloride are dropped into the eye. After waiting one minute cocaine is again instilled, and about two minutes later the eye is ready for operation. The action of adrenalin is more intense in some individuals, and in these cases extreme dilatation of the iris may take place, particularly if a strong solution of adrenalin is used, or if the instillation of adrenalin is commenced too long before the operation. When used as a therapeutic agent adrenalin may be with advantage combined with cocaine hydrochloride and cyanide of mercury. Darier[1] recommends the following prescription, which has been extensively employed by the writer:—

Hydrochloride of cocaine	0·10	gr.
Solution of 1 in 1,000 adrenalin	1	„
Solution of 1 in 2,000 cyanide of mercury ...	10	„

The following extracts will perhaps exemplify more clearly the benefit which may be obtained by the use of this reagent in cases differing widely in origin.

[1] Darier, "Ocular Therapeutics"

Miss M., aged 25. Right eye − 13 diop. spher. − 2 diop. cylind., axis vertical. Left eye + 1 diop. spher. + ·5 diop. cylind., axis oblique. The patient suffered from chronic hyperæmia of the right eye, accompanied by troublesome lachrymation. Binocular vision was not present, the patient making no use of the right eye. Various methods of treatment had been employed without appreciable result. The last treatment that had been employed was the local application of protargol, together with the administration of ichthyol internally. The refraction was first corrected and the patient advised to make use of the right eye for reading, the left eye being covered with a shade. The patient did so for a short time daily, increasing the time from day to day. The prescription quoted above was employed, the patient applying the adrenalin and cocaine every two hours. In two months the adrenalin was entirely given up and there was no return of the hyperæmia. In this case the cosmetic effect alone was of the greatest value to the patient.

N. S., aged 39, complained of absolute loss of vision, severe pain, and redness of the left eye. There was no œdema of the lid or conjunctiva. The tension was plus one. The conjunctiva was greatly congested. There was some cloudiness of the conjunctiva. The anterior chamber was shallow and the pupil regularly dilated. The lens was opaque, greatly distended, of a bluish-white colour, and silky in appearance. Perception of light was present. An iridectomy was first performed. The tension became normal, and the pain disappeared immediately after the operation. However, a fortnight after the operation, the conjunctival congestion had only slightly improved. A solution of adrenalin hydrochloride, 1 in 10,000, was instilled every two hours. A few days later the strength of the solution was increased to 1 in 5,000. Three weeks after the operation for iridectomy was performed the congestion had almost entirely disappeared. The tension had risen somewhat but was less than plus one. It was decided that the lens should be removed. Upon making the usual incision the lens was expelled spontaneously, the capsule rupturing and presenting in the wound after the exit of the lens. After the operation great conjunctival congestion remained for several weeks; ultimately, strong solutions of adrenalin were used (1 in 2,000), and the congestion completely cleared up. The patient's vision was corrected to $\frac{6}{24}$ Snelling. It may be mentioned that the cataract was apparently a genuine glaucomatous one, although perception of light was present, and not cataracta in oculo glaucomatoso.

NOTES ON AN EPIDEMIC OF ENTERIC FEVER.

By Captain W. E. HUDLESTON.
Royal Army Medical Corps.

The following are some notes on an epidemic of enteric fever in the "Carabineers," at Mhow, during the months of February, March, April and May, 1907.

The barracks have been occupied by the present regiment since the middle of October, 1906. Previous to that they were occupied by the 10th Hussars, and this regiment suffered severely from enteric fever in the years 1903, 1904, 1905 and 1906 (see Table I.). Table II. shows the incidence in individual bungalows for the past four years; the extraordinary preponderance of cases in Barrack No. IV. and the almost entire escape of Barrack No. III. should be noted. The exemption of Barrack No. III. is difficult to explain; it was occupied mainly by the band of the 10th Hussars, and since their arrival the band of the "Carabiniers" have occupied it; other parts are occupied by signallers and some seven or eight nursing orderlies, most of them nursing enteric fever cases. The accompanying map of the Cavalry Barracks also shows that the band cook-house has a latrine in front of it and a urinal behind it, the back of the cook-house building itself being a wash-house. No. IV. Barrack comes into near relation with two latrines, but otherwise its surroundings are as sanitary as any other barrack.

There appears to be no sanitary defect which would explain why enteric fever has been so prevalent in No. IV. in the past, or why it should be responsible for nine cases out of fifteen this year. We must look, therefore, for some other explanation for the "B" Squadron epidemic, and one naturally turns to the features of the epidemic, which I will briefly describe.

A glance at the Cavalry Barrack map will show the chronological order of the cases and the bungalows in which they occurred. The index of the map shows the date of admission, but what is infinitely more important, the approximate date of onset of each case. In most cases the patient gives a very definite date on which he first fell ill, began to suffer from headache, diarrhœa, or other symptoms. The latrines and urinals each bear the letter of the squadron to which they belong. The cook-houses are suitably labelled.

No. 1 Case was admitted on February 7th; he was sent in from

field manœuvres, which started six days before. He stated that he first fell ill one or two days before starting on manœuvres, and had therefore been a possible source of infection to his comrades in barracks for two days. *He had been in the habit of using both "A" and "B" Squadron latrines.* The map shows that these latrines are almost equally handy to the occupants of No. IV. Barrack. The source of infection in this case remains a mystery; the only cases of enteric fever in the station at the time were in the infantry barracks 1½ miles away. He was a steady man and did not eat or drink in the bazaar.

No. 2 Case was admitted on February 14th. He did not accompany his squadron on manœuvres. *He stated that he had been ill, suffering from diarrhœa—six or seven stools a day—since February 7th.* He also stated that he invariably used "A" Squadron latrine, but this is difficult to entirely credit, as it will be seen from the dot map that he lived slightly nearer "B" Squadron latrine. However, as a possible spreader of infection, either by latrine or other intermediate contact, the importance of this case can scarcely be over-estimated.

Case No. 3 was admitted on February 21st. First ill on February 15th. He stated he used both "A" and "B" Squadron latrines, and as he occupied Room 9, either would be handy. The source of infection was possibly latrine contact with Case No. 2.

Case No. 4 was admitted on March 2nd; first ill on February 27th. He was employed many hours daily in the riding school, with the result that he was often late for meals. He volunteered the statement that he frequently found his food had been left uncovered in the barrack-room, and it was covered with flies. His room (see dot map) was on the ground-floor, and flies from both latrines more than probably settled on his food. These latrines could undoubtedly have been infected by Cases Nos. 2 and 3, up to February 14th and 21st respectively, fourteen and eight days before this man first fell ill.

Case No. 5 was admitted on March 5th; first fell ill on February 27th. On February 14th Case No. 2 was admitted from the same room. This man developed the disease fourteen days later. What more suggestive of latrine or other contact infection, when one remembers the features of Case No. 2?

Case No. 6 was admitted on March 7th; first ill on March 3rd. Living on the lower floor nearly opposite a latrine.

Case No. 7 was admitted on March 9th; first ill on March 3rd. Living in the same room as Case No. 2, and developed the disease seventeen days after Case 2 left for hospital.

Case No. 8 was admitted March 10th; first ill on March 6th. Belonging to Barrack No. V. There are two possible sources of infection: (*a*) "A" Squadron latrine, infected by Case No. 2, at the last possible date, twenty days before; and (*b*) association with Case No. 9, who was employed with this man in the forge, and used the same latrine.

Case No. 9 was admitted March 10th; first ill on March 7th. Lived in same room as Case No. 6.

Case No. 10 was admitted on March 20th; first ill, probably, about March 13th. An ambulatory case. Died of perforation seven days after admission. Room No. 16.

TABLE I.—ENTERIC FEVER CASES IN 10TH HUSSARS.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1903	1	2	11	13	11	3	3	1	1	3	0	0
1904	5	0	1	4	4	1	7	0	1	0	0	0
1905	0	1	0	2	1	0	0	2	1	0	0	3
1906	2	0	4	7	3	1	10	5	0	3	Left	Station

TABLE II.—ENTERIC FEVER AS IT OCCURRED IN BARRACK BLOCKS.

Year	I.	II.	III.	IV.	V.	Total
1903	12	11	0	15	11	49
1904	9	3	0	4	7	23
1905	2	2	1	3	2	10
1906	6	5	0	15	9	35
Total	29	21	1	37	29	117

Case No. 11. A doubtful case. Cause not traced.

Case No. 12 was admitted April 5th; first ill April 3rd. Case occurred in Bungalow No. 1. He was semi-comatose for twelve days after admission and no information could be got from him. Source not traced.

Case No. 13 was admitted on April 17th; first ill April 11th. Last in contact with Case No. 8, twenty-three days before.

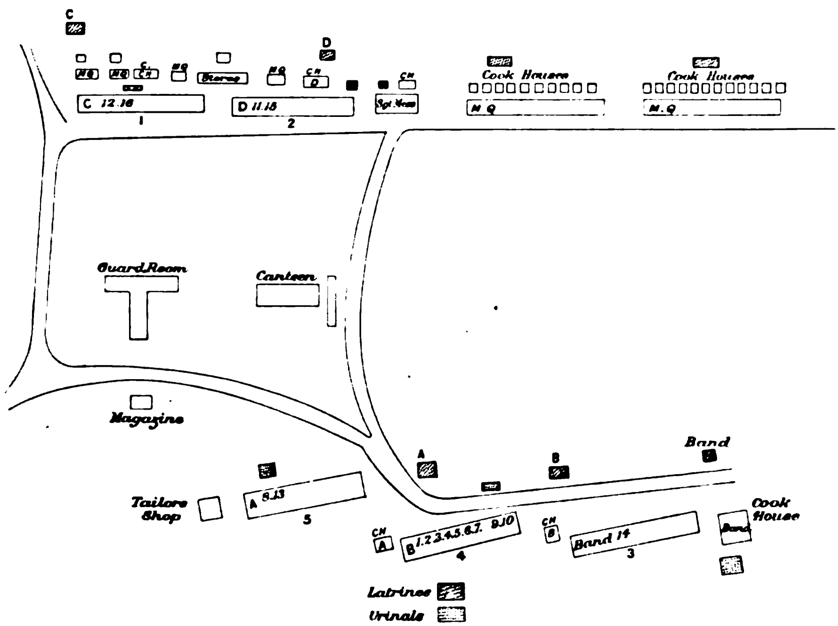
Case No. 14 more than probably was infected in hospital. Admitted on April 17th; first ill on April 15th. Blood, on admission, contained malarial parasites. On April 24th, after giving quinine, temperature was normal, then began to rise gradually. On May 2nd had typical typhoid stools.

Case No. 15. A sporadic case. Source not traced. He stated he was in the habit of eating raw tomatoes and onions.

Case No. 16. Source not traced.

This epidemic presents many features like other company epidemics described from time to time in the Journal. I think it may be claimed that latrine or other intermediate contact infection most satisfactorily accounts for its spread in "B" Squadron. It presents none of the features of a water-borne epidemic, though a

MAP OF CAVALRY BARRACKS.



INDEX.

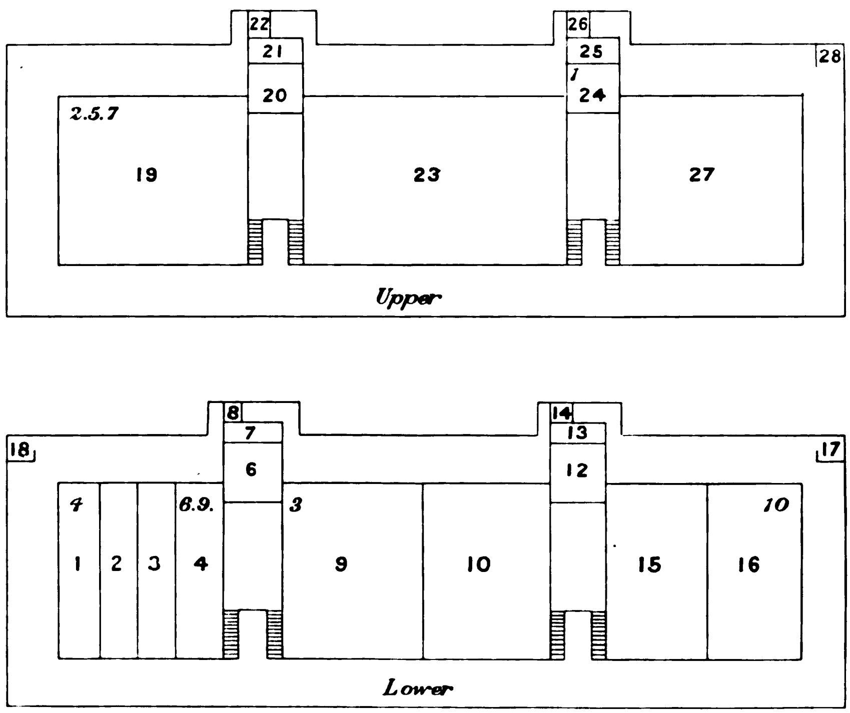
No.	Name	Date onset	Date admitted	No.	Name	Date onset	Date admitted
1	Corpl. B. ..	1.2.07	7.2.07	9	Corpl. G. ..	7.3.07	10.3.07
2	Pte. M. ..	7.2.07	14.2.07	10	Pte. H. ..	13.3.07	20.3.07
3	,, A. ..	15.2.07	21.2.07	11	,, B. ..	21.3.07	24.3.07
4	Corpl. H. ..	27.2.07	2.3.07	12	,, C. ..	3.4.07	5.4.07
5	Pte. McC..	27.2.07	5.3.07	13	,, M. ..	11.4.07	17.4.07
6	,, L. ..	3.3.07	7.3.07	14	,, B. ..	15.4.07	17.4.07
7	,, P. ..	3.3.07	9.3.07	15	,, C. ..	27.4 07	30.4.07
8	,, B. ..	6.3 07	10.3.07	16	,, J. ..	9.5.07	12.5.07

bacillus giving nearly all the cultural characteristics of *Bacillus coli* was isolated from the drinking-water tank at the commencement of the epidemic.

On February 16th No. 4 Troop was given a separate latrine, and completely new *gumlahs* were provided for the squadron latrine.

On March 21st the whole squadron went into camp, provided with separate cooking, washing and latrine arrangements. No case occurred in "B" Squadron after they moved to camp. However, the epidemic appears to have ceased spontaneously about this time, otherwise one would have expected previously-infected cases to still come in for a short time.

"B" SQUADRON, OR NO. IV. BARRACK ROOM DOT MAP.



The figures in italics represent serial numbers of cases of enteric fever; those in ordinary figures represent the numbers of rooms.

Most of the attacks were severe. Many cases complained of very severe sore throat during the first week. Another feature was the occurrence, in many cases, of broncho-pneumonia towards the end of the second week, giving rise to prolonged irregular fever.

Case No. 4 developed a localised empyema which was opened and drained. The pus contained staphylococci, but an attempt to cultivate *B. coli* and *B. typhosus* failed.

All the cases were fed on whey and white of egg; in the earlier

cases cream was added, but the cream was found to contain a certain quantity of milk, and, a good deal of fæcal residue occurring during its use, it was abandoned. Sanatogen was tried in one case from the commencement, and in five cases in which convalescence was slow and emaciation extreme. I think it will be found to provide a very useful and necessary proteid element to add to the whey and albuminous diet. Two drachms, thrice daily, were administered.

Many cases developed a scorbutic taint, which was combated by giving fresh limejuice. In many cases treated on whey diet there seemed to be a rather undue tendency to intestinal hæmorrhage. I should like to hear of any similar experience.

In collecting information about this epidemic I was much struck by the difficulty in obtaining reliable evidence. The sick report is a document too often carelessly prepared. In some cases the man's barrack number was wrongly stated; seldom was his room number given. Men specially employed, such as orderly room staff, signallers, &c., often do not live with their companies or squadrons. Men may be transferred from one squadron to another whilst incubating the disease, or during the early stages, in which case the date of onset of the disease is of much importance. Men, as in this epidemic, may be using several latrines besides their company one. All these points appear pretty obvious to anyone, but let such an one endeavour to work out the causes of an epidemic and he will find how very easily sources of error creep in and falsify his deductions.

COMMENT ON A METHOD OF DRYING CLOTHES ON ACTIVE SERVICE, AS TRIED DURING THE LAST SCOTTISH MANŒUVRES.

By Captain C. F. Wanhill.
Royal Army Medical Corps.

In all countries, excepting perhaps the Soudan, where war and the preparation for war require the soldier to expose himself to the elements in a manner for which he is more or less unfitted by civilised life, the problem of how to deal with wet clothing is a serious one, nowhere more so than in the uncertain climate of these Islands. Where rain and sunshine alternate it is possible to dry clothes in the open, but when the conditions which attended the last Scottish manœuvres maintain, the whole of the men's kits are constantly wet through.

Contrary to expectation, these conditions did not conduce to ill-health among the troops concerned at the time, though one might reasonably expect that, in cases where a soldier's constitution was not of the best, the foundation of future disease might be laid. Whether adverse climatic conditions conduce to disease under these circumstances or not, there can be no doubt that a great deal of personal discomfort could be avoided if some simple means of drying clothing on active service could be devised.

At Ballinluig, in Scotland, in the camp of Lovat's Scouts, the plan of heating stones in a tent and using the heat they gave out to dry the clothes was tried, on the suggestion, I believe, of Colonel Rimington; but the troops were not a sufficiently long time in camp for a prolonged test of the method to be made.

The detail of the process was as follows : Holes were dug in the ground enclosed by a tent (for preference a marquee), sufficiently far from the poles and canvas to minimise the risk of fire, and lined with stones, of such a size that the air could get to the fire through the interstices. A fire was then lighted in the hole, and stones added till there was a good pile of hot stones and ashes in the hole. The men's clothes were hung round the hole, as well as the appliances on the spot allowed, and the tent shut up. It was found that, by this means, the articles in the tent were dried, more or less, according to their distance from the fire.

There were several dangers attending this process. Unless the fire was carefully tended, the tent, though probably soaked with

rain, ran a risk of being burnt; the clothes, hung too close to the fire, were apt to get scorched. In actual practice the tents did not catch fire, owing to their being very wet, a condition which would probably accompany the need for clothes-drying, but the operation of heating the stones certainly looked somewhat alarming. The second danger could be obviated by the occasional moving of the clothes from front to back, as they got dried, losing as little heat as possible.

On active service, where there is no objection to the cutting of turf, a turf hut, roofed with some brushwood or hurdles and mud, or with galvanised iron, would probably make an excellent drying house, its capacity being only limited, for drying clothes, by the number of articles it could contain. The heating apparatus might also be improved by the building of a cairn of stones with a hollow centre for the fire, instead of an open hole. The flames would then rise through the spaces between the stones, effectually heating them, and the danger of fire from the flying sparks of the brushwood would be less. A hole in the roof would provide a draught and a means of getting rid of the smoke which, with green wet wood, is apt to be troublesome, the hole being closed by a section of turf as soon as drying commences. There are, of course, difficulties in connection with the burning of wet wood, but the cooks have to meet and overcome the same difficulty in the open air, while the drying house would be roofed.

Although the method is far from perfect, it seems to be the only contrivance at present possible with the appliances usually to hand, and, as there is a distinct want for some such arrangement, one is inclined to think that it is worthy of a more extended trial, to ascertain its imperfections and to discover, in what directions perfection may lie.

A NOTE ON THE TREATMENT OF GONORRHŒA.

By Captain J. E. HODGSON.
Royal Army Medical Corps.

This note is written after reading the interesting article, "The Treatment of Gonorrhœa in the Army," by Major H. C. French, R.A.M.C., in the June number of the Journal.

In that article Major French lays down, as the result of his experience, certain very definite rules regarding the treatment of the disease in question, more especially with regard to irrigation, diet, and general treatment.

I have had charge of the venereal wards at the Station Hospital, Ranikhet, India, for the past eighteen months; during the last sixteen of which I have used the irrigation method exclusively. As the procedure adopted, however, has not been on all fours with that laid down in Major French's article, and, indeed, in some important respects, is opposed to it, I propose to bring to notice the details in respect of which the schemes differ, with the results obtained under the method I have used. I do so without prejudice in favour of any differences I may have to note, but simply by way of comparison and comment, from which point of view the facts may be of interest. My cases have totalled only eighty-seven against Major French's five thousand odd, and such figures do not of course afford a satisfactory basis on which to compare results. The following remarks are therefore put forward merely as the result of my own experience, as a matter of interest to anyone who may have worked at the subject.

In the first place, however, referring to one of the opening remarks in the article quoted, as to the amount of gonorrhœal disease among soldiers which is only discovered incidentally after having existed for a considerable time, I may mention that of the eighty-seven cases treated here, no less than fifty-eight (or 66 per cent.) were found on admission to be suffering from chronic gonorrhœa, as evidenced by Thompson's test and the microscope. Of the remaining twenty-nine, only five (or under 6 per cent.) were of acute anterior type, the remainder all showing disease of the posterior tract. Forty of the cases had had previous admissions for gonorrhœa during their service. It may be safely stated, therefore, that all these men except five had been going about with gonorrhœa

for anything from three weeks onward, before admission to hospital. The danger of these individuals to women and other soldiers needs no comment.

I find that the average time spent in hospital here has been forty-nine days, or, taking the average for each particular type of disease separately, forty-six, fifty-three, fifty, and forty-nine days for acute anterior, acute antero-posterior, chronic anterior, and chronic antero-posterior disease respectively. These periods include, in each case, a final one of seven days, during which the urine remained perfectly clear in spite of a liberal allowance of beer and physical exercise, and during which all local treatment was stopped.

On the day of admission a smear of the urethral discharge is examined microscopically, and the first urine passed next morning subjected to Thompson's test. This latter test is applied daily to the first of the day's urine throughout the patient's stay in hospital, the result recorded in a treatment-book, and irrigation ordered accordingly. For the first day after admission the patient has milk diet and a purge, but after this, in the absence of any counter-indication, such as epididymitis or other complication, a meat diet is ordered, with 2½ pints daily of barley water, the latter to promote diuresis and free flushing, *á tergo*, of the diseased tract. Mist. alba is given daily in the early morning until or unless counter-indicated. I have not found any bad results from the use of a meat diet. It tends to maintain the patient at a better physical level, and, a most important point, promotes the acidity of the urine. Milk diet, in addition to lowering a man's physique, if continued for any length of time, undoubtedly tends towards a diminution of the urinary acidity.

The ordinary case, *i.e.*, one of uncomplicated gonorrhœa, whether acute or chronic, and of anterior or posterior type, is not kept in bed. He is marked "up" on the day after admission, and in addition does an hour's light physical drill daily. Here, again, I have not seen any evil result. In only two cases out of the eighty-seven did epididymitis develop during treatment, and these two are indeed outside the question, as they were excused physical drill on account of anæmia and general debility. Both had chronic antero-posterior disease, and the epididymitis did not develop until after three weeks in hospital. The result, therefore, of my observations on such cases as I have seen, is that neither meat diet nor physical exercise are in any way harmful in uncomplicated gonorrhœa, even when acute. They certainly promote

physical fitness better than milk diet and lying in bed. This is an important point in the case of the soldier, who, on leaving hospital, resumes immediately a physically active life, and should be discharged in as hard a condition as possible to meet the demands made on his endurance.

As regards irrigation in acute cases, so emphatically dissented from by Major French, I have invariably carried this out from the day of admission, with no untoward results, except perhaps in the two cases in which epididymitis occurred subsequent to admission. Both were weakly, anæmic lads, malarial subjects, and I am by no means satisfied that the irrigation played any part in inducing the complication. As against this possibility is to be noted the immediate and marked improvement, both naked eye and microscopical, which followed irrigation after admission. This is confirmed by three other cases of epididymitis which were admitted with this complication. All three cases were irrigated from the beginning, and the testicular symptoms rapidly cleared up, and did not recur. They lessened, in fact, as soon as irrigations were commenced. The latter, of course, were supplemented by the usual measures for relief, such as counter irrigation and support. The irrigation is, in such cases, very carefully done, the anterior urethra being first thoroughly cleansed by double flow lavage with a Maiocchi's tube.

As before stated, I have only had five cases of simple acute anterior disease to deal with, and these afford none but the fallacious "particular to the general" style of argument for or against Major Pollock's view, that irrigation in the initial acute stage prevents infection of the posterior urethra. Certainly, though irrigated from the first, no extension occurred in my cases. While on the subject, however, I would add the suggestion for what it is worth, that such extension is more probable under Diday's method, perhaps unskilfully or carelessly performed, than with a Maiocchi's double channel tube. It would appear easy enough with the former to carry infection, by actual contact of the catheter, to the entrance to the posterior area, whereas with a Maiocchi's tube properly made, *i.e.*, with the exit lumen larger than that of the entrance channel, and with a properly graduated head of irrigating fluid, the inter-urethral pressure is so low, and the contraction of the compressor urethra so strong (the man being told to "hold his water" during the process), that no forcing of the fluid, or infective material, is possible. Except the above-noted two cases of epididymitis (among fifty-nine cases of posterior disease), and two of rheuma-

tism, which occurred during the rains, were mild and not of gonorrhœal type, I have seen no complication whatever in the cases under treatment here by irrigation methods.

With regard to recurrence of the disease after discharge from hospital, the urine of each patient has been examined seven days after return to duty, and the men have been frequently seen at venereal inspections. Among the eighty-seven cases there have been six (or 6·9 per cent.) second admissions, and no men were admitted more than twice. Three of these cases were found to have some urethral discharge within, in one case five, in the second two, and in the third three days after leaving hospital; and from enquiries made I strongly suspect that the cases fall under the category of those mentioned by Major French, where clear urine had been substituted for their own. They were all anxious to be "marked out" on account of the physical drill, which struck hard in many cases at a cherished tradition of "loaf," and because of loss of pay. The thing is not capable of positive proof, but it is unreasonable to assume that in the short interval between discharge and re-admission, in cases where the urine had been macroscopically and microscopically clear for seven full days, in spite of exercise and a liberal allowance of beer, a urethritis should recrudesce sufficiently to show purulent discharge. Of the remaining three cases admitted a second time; one, discharged after chronic disease, was re-admitted seventy-nine days later with acute disease; the second, discharged after chronic disease, was re-admitted nineteen days later with acute disease; and the third, discharged after chronic disease, was re-admitted with a similar condition after an interval of forty-two days. The last-mentioned was probably a true relapse; the two former, one of whom confessed to possibilities in the interval, are doubtful. The type of the disease on re-admission suggests fresh infection.

For the ordinary acute case I have been using permanganate of potash of an average strength of 1 in 4,000, given twice daily, whether for anterior or posterior disease—posterior irrigation is done with a glass nozzle fitted with a cup-shaped shield, the concavity being towards the nozzle, made by the Holborn Surgical Instrument Company. The shield affords protection to the operator in the not unusual event of a strongly contracting compressor urethræ causing a spurt of the injection fluid from the meatus during irrigation. The patient lies down for the irrigation, which is performed by the medical officer or a properly trained Assistant-Surgeon. I have found, in the large majority of cases, that

relaxation of the compresser urethræ for posterior irrigation is more easily obtained thus, than when the patient sits or stands.

The chronic forms of disease receive as a rule one irrigation daily of silver nitrate, usually about 1 in 4,000.

If local application to an ulcerated urethral patch is required, Ultzmann's sound is used with silver nitrate solution of a suitable strength (about 1 in 50). It is possible with this instrument, or an ordinary metal sound, to localise very definitely the site of such ulcerations, and they rapidly heal under this treatment.

For dilatation of the mucous crypts in chronic cases, an ordinary metal sound of suitable size is used. When this is *in situ*, the urethra and prostate are gently massaged. I have found this plan quite as effective as rectal massage. The practical result of such massage may be observed by receiving the fluid returned after the irrigation into a glass.

It would seem a very sound plan to use case sheets for all gonorrhœa cases, on the same lines as the syphilis case sheet, wherein all admissions, with type of disease, bacteriological notes, complications, and results of observations after leaving hospital, would be recorded. One is constantly met with the difficulty, in investigating a new admission, that only very scrappy and incomplete information as to previous gonorrhœal history is available. The medical history sheet with its bare laconic legend, "Contagious. Inspection. R.," or "Usual, mild, R.," followed not infrequently by one or more equally perfunctory notes to the same effect at deplorably short intervals, and the unreliable statements of the patient, are the only available data. It is the rule rather than the exception to find threads, squamous epithelium, and a paucity of gonococci in a man who will unblushingly tell one that he "never had it before, and got it last week." Considering that most men are inaccurate in their statements, and the medical history sheets almost invariably silent about the extent of the disease and all other essential data, some plan of complete record such as would be provided by a well-devised case-sheet is very necessary.

It is a question, too, whether enquiry for previous gonorrhœal disease should not be made part of the medical examination of every candidate for enlistment. It must be the case that many men are accepted as recruits who are the subjects of gonorrhœal infection. No one would think of passing a syphilitic for the Army, whereas the equally important gonorrhœa, which figures largely, if not so largely, as a cause of inefficiency, is to all intents and purposes not taken into account in the medical examination

of the recruit. One is struck, on going through the medical history sheets of a unit, with the large proportion of the sheets which bear entries for this disease; how a man has been admitted again and again since the date of his enlistment; and with the enormous loss of time and service to the State the days in hospital represent in the aggregate. No disease, perhaps, is more liable to recurrence, at all events under earlier methods of treatment; no class of sufferers so much the victims of quackery and futile remedies in civil life; and it is not to be supposed that all the gonorrhœa shown in soldiers' records has had its origin in infection contracted since enlistment. It would be a simple matter to apply the Thompson urine test to recruits, and the information gained would be of the utmost value. A positive result need not necessarily imply rejection for the Service, but at least it could be made to ensure systematic treatment at the outset of a man's service, until the disease had been eradicated.

Another interesting point suggests itself on the question of bacteriological diagnosis in urethral disease, from the point of view of the soldier admitted to hospital with "gonorrhœa." This point is whether, when frequent and adequate microscopical examination fails to detect the specific diplococcus, the disease should still be returned, merely on naked eye appearances, and *faute de mieux*, as gonorrhœa. Apart from the medical interest of the point, it is one specially to be considered in fairness to the patient's personal interests. In the Army, under existing orders, admission to hospital for gonorrhœa is practically a crime in the consequences it entails of loss of pay, efficiency, employment, &c. A heavy responsibility lies, therefore, with the diagnosing medical officer, whose verdict makes all the difference to a patient financially and in his Service prospects. Granted that by far the commonest cause of urethritis is the gonococcus, there remains still the admitted fact that such a disease as non-gonorrhœal urethritis occurs; rarely, perhaps, but not very rarely. The specific organism is, even in chronic cases, comparatively easy, perhaps the easiest, to demonstrate, if carefully, frequently and systematically hunted for. I have had several cases, to all naked eye appearances differing in no respect from ordinary gonorrhœa, in which the gonococcus could not be found from the date of admission to that of discharge. Organisms were present, but not the specific one; and examination of the source of infection showed leucorrhœa or uncleanliness, not gonorrhœa. The principle of bacteriological diagnosis is nowadays so generally applied, that there appears no reason to exclude

gonorrhœa from the list. The accommodating "simple continued fever" is no longer permitted as a refuge for the destitute; why, then, should urethritis, a symptom merely, and common to several causes, be returned as gonorrhœa if the evidence of the microscope is negative. The dictum that a negative result is no proof, is not of universal application. I think it is not to be accepted blindly in the case of the gonococcus, an organism so easy to demonstrate when present. Admitted even those cases, a very numerous class, in which an original gonorrhœal infection predisposes to the kindling of a subsequent non-specific urethral or prostatic catarrh after alcoholic or other indiscretions; are these oft-recurring "gleets" to be returned by rule as "gonorrhœa," ignoring the negative microscopical results; and the man to suffer again and again in pocket and prospects, for a disease for which he may already have been mulcted in these respects and in health? In short, are sequelæ, and are the conditions predisposed to by former disease, the disease itself, in its personal consequences? I make no plea for grace for the case provedly gonorrhœal; but I ask whether, when painstaking and systematic use of the adequate facilities at our command tells us that the essential factor in the diagnosis of a disease for which punishment is imposed is absent, the patient should not have the benefit of our failure to afford the essential ultimate proof against him? The answer surely, in logic and fairness, must be "Yes"; but the suggestion is looked at askance. Nevertheless, should not all its pros and cons be considered, and the rule admitted that gonorrhœa is to be diagnosed on bacteriological evidence? The disease stands alone in this connection as the only one of its class (involving forfeitures, &c.) in which specific and non-specific naked eye-appearances so closely resemble each other. It is thus peculiar in being the only one of the kind the diagnosis of which ultimately depends on the result of an appeal to the microscope.

Clinical and other Notes.

SOME NOTES ON DIETING IN STATION HOSPITALS IN INDIA.

By Lieutenant-Colonel M. W. O'KEEFFE.
Royal Army Medical Corps.

The careful daily inspection of food supplied to Station Hospitals, both at home and abroad, ensures that it is of excellent quality and the best of its kind procurable. But the manner in which it is put before the patient, and dealt with in the way of cooking, leaves much to be desired. I have long been of opinion that there is great room for improvement in this respect. The small tin dish, containing a couple of slices of meat, floating in tepid gravy, with its complement of luke-warm vegetables and lumps of congealed fat floating about, is painfully familiar to all of us.

While recently in charge of the Medical Division of the Royal Herbert Hospital, Woolwich, the system in force was to have the joints brought from the kitchen to the dining hall and carved there; each man also had a pudding daily. I have endeavoured to introduce a similar system in the Karachi Station Hospital, with some modifications to suit local conditions and hospitals in India. The following is the routine now adopted after a two months' trial and experiment.

Assistant-Surgeons in charge of wards get a list from the medical officer of all men who are fit to dine in the dining-hall. This is sent in to the senior Assistant-Surgeon one day in advance, so as to enable him to compile his daily diet returns, &c. All the men on the list have the same diet for the day, but, as the following specimen of the weekly menu will show, there is a change of diet every day :—

Days	Diet	Puddings
Sunday	Mutton, roast	Rice
Monday	Beef, roast	Custard
Tuesday	Beefsteak pudding	Bread
Wednesday	Mutton, roast	Sago
Thursday	Beef-steak pie	Vermicelli
Friday	Beef, roast	Rice
Saturday	Mutton, boiled	Bread

A half pint of soup per man is given daily; this can easily be managed by a little care on the part of the cook, of spare portions of meat, bones, &c. If necessary a couple of tins of Edwards' concentrated soup or a small jar of Liebig could be added. The hot joints are brought on enamelled dishes, in wooden trays with covers, from the cook-house to the dining-hall and carved by the men themselves. At first it was thought that this might not work, that young soldiers might not know

how to carve, or might not give a proper portion to each man. In practice it has been found to work without a hitch, the men being well able to take care of themselves. The Assistant-Surgeon on duty and a corporal are told off to supervise, but there is never the slightest trouble. There is also a liberal allowance of pudding for each man daily, so that he gets a solid, comfortable three-course meal once a day. It is a great boon for the soldier to have his food served in a civilised manner and in a different room from his ward, which is practically a bedroom, and may have seriously ill or dying patients in it.

It may be argued that this is all a considerable extra expense to Government, but on looking carefully into the matter it will be found that this is not the case. With regard to the soup course the only extras are the couple of tins of Edwards' soup, which would probably be ordered in any case in the ordinary routine of hospital dietary. In large hospitals this addition could be easily dispensed with. In the meat course on Tuesdays and Thursdays, flour is required for beefsteak pudding and pie. This has been worked out, and the minimum allowance required is 6 ozs. of flour per man, and on the other days there is nothing extra. This is a small item and does not cost more than a tin or two of Benger's food, for instance. The change from the eternal round of "roast" and "boiled" is so much appreciated by the men that I think the small extra cost is more than justified. In the pudding course, by cooking in bulk, there is a saving and not an increase of expenditure, although each man gets a portion daily. By cooking one pudding for twelve men the ingredients of six small puddings are found to be more than enough for the twelve, and under this system it has been found that a smaller total number is ordered than heretofore. Nobody would think of allowing such a wasteful arrangement in a private house as a separate pudding for each individual, and it is quite time it ceased in military hospitals.

A daily diet-sheet is kept by the Officer Commanding Station Hospital, on which he enters the requirements for the dining-hall. As an illustration, take Thursday with, say, forty men dining; the only entries required would be flour, 15 lbs., and vermicelli puddings, twenty, the medical officer in charge of wards entering up on the ordinary diet-sheets in the wards the diet for the day. This saves a great deal of clerical labour to the medical officers and to the Assistant-Surgeon in the compilation of the daily diet returns.

A certain amount of plant is required, which is not laid down in the authorised scale for Station Hospitals, such as carving knives and forks, large enamelled dishes for joints, &c. This is not a heavy item, and any regiment that has the comfort of its men at heart will not hesitate to subscribe the required amount. A sum of 70 shillings was found quite sufficient in the Karachi Station Hospital to purchase the above, some flower vases and table decorations.

I have ventured to publish this short description as I think it may be useful to my brother officers who are in charge of Station Hospitals, and as experience has shown that this system adds so materially to the comfort and well-being of the patients.

A PECULIAR CASE OF SURGICAL EMPHYSEMA.

By Captain L. BOUSFIELD.
Royal Army Medical Corps.

An Egyptian bugler was blowing his bugle when he was suddenly seized with a sharp pain in his chest near the manubrium sterni. On the following day his condition was as follows :—

He had no severe pain, but complained of aching in his neck. A diffuse crepitant swelling was found, spreading over the neck from just below the maxilla to about one inch below the lower border of the manubrium ; at the sides it spread over the sterno-mastoids, and there were two lateral wings which extended outwards three-quarters

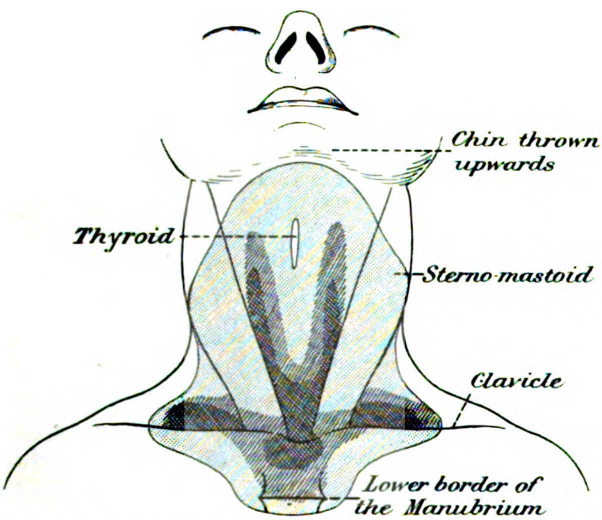


Diagram showing Extent of Emphysema. Shaded area is that of the surgical emphysema—the darker the shading the more the air.

of the length of the clavicle along its posterior aspect. The swelling was symmetrical, and its extent is shown in the accompanying diagram. On palpation there was no pain, but crackling could not only be felt beneath the fingers, but could be heard, even without the aid of the stethoscope. Though complaining of slight pain, he was not in any way seriously ill. There was no fever ; pulse-rate, 70 ; respirations normal in

number, and apparently having no influence on the size of the swelling. He presented no signs of lung disease (emphysema or tubercle), nothing abnormal was seen in his pharynx or larynx, and there were no enlarged glands in his neck. He gave no history of previous lung trouble, and was in appearance a strong and healthy man.

This must have been a case of traumatic rupture of an air vesicle of the lung from excessive straining when blowing his bugle, the air escaping probably through Burn's space, otherwise it would be difficult to account for its distribution. The air seemed to lie between the skin and the superficial layer of the cervical fascia, but how it gained access to this space from the lungs or the trachea is a problem, having to pass through the visceral and parietal layers of the pleura if from the former, and the deeper layers of the cervical fascia if from the latter.

The absolute symmetry of the distribution of the air is also of interest, evidently indicating places where the connective tissue joining the skin to the superficial layer of the fascia is very loose, hence showing the lines that suppuration would probably tend to take in this region between these layers.

In the limited amount of literature at hand, I can find no reference to such a case, and I believe it to be of very rare occurrence, and so worthy of being placed on record, especially as this case shows no signs of emphysema or tubercle.

A CASE OF LIVER ABSCESS DUE TO A DIPLOCOCCUS SIMILAR IN APPEARANCE AND STAINING-REACTION TO THE GONOCOCCUS.

By Captain L. BOUSFIELD.
Royal Army Medical Corps.

Nafar Moursi Mohamet Ismael was admitted to the Kassala Military Hospital on July 22nd, 1907, suffering from pyrexia; temperature, 101° F. He looked ill and was thin. He made no complaint, except that he had fever with the accompanying headache and pains in the back and limbs. He presented no physical signs of disease, and no malarial parasites were found in his blood. His temperature at night rose to 104° F., accompanied with considerable perspiration. He had slight diarrhœa, but there was no blood or slime, and no history of dysentery. His urine was normal.

His temperature remained high, varying mainly between 102°—104° F. for the next twenty-four days. His spleen was slightly enlarged to percussion, and about a week after admission to hospital there were a few râles and rhonci in the chest; there were no rose spots. He had been having quinine prophylactically and, in spite of no parasites being found in his blood, he was given a long test with this drug, but it had no effect on his pyrexia.

The blood was again examined on July 27th and August 1st, but no malarial parasites were found, though on July 27th a leucocytosis was noted, but on August 1st this had disappeared. On August 3rd a slight increase of liver dulness was noticed on the right side beneath the axilla, and slight pain was elicited on pressure over this part. The next day a slight pleuritic rub developed over this region, and the patient complained of slight pain. The following day he was needled, but only blood was withdrawn. From this time onwards he complained of no pain.

The small patch of dulness remaining, he was again needled on August 15th with no result, except that during the next forty-eight hours his temperature fell to normal. His general condition, however, was getting worse and worse, the pulse-rate rising to 136, and he was bathed in perspiration.

On August 17th his temperature rose again to 102° F., and on August 19th, in spite of his very bad condition, he was anæsthetised, as the area of dulness had considerably increased. On needling, clear fluid was withdrawn, evidently from the pleural cavity, but it was not till the fifth puncture that thick, yellow, creamy pus was withdrawn. The ninth rib in the posterior axillary line was resected for about 1½ inches, and about a pint of clear serous fluid escaped from the pleural cavity; the diaphragm was then stitched to the parietal pleura, an incision made through it by means of the actual cautery, and about 1 ounce of thick pus evacuated from the liver. The cavity was very ragged and appeared to be of a more or less acute formation, as the walls were very friable; there were two small pockets. The patient was extremely collapsed, requiring 20 minims of strychnine and 10 minims of ether hypodermically.

The following day his condition had improved and his temperature reached normal on August 21st, the pulse on August 22nd falling to 102°, and the sweating had gone. The temperature had again risen to 101° F., falling to normal in the morning, but the general condition had greatly improved.

This was taken to be a case of tropical abscess, but the reason for publishing it is on account of the bacteria found in the pus. Pus taken soon after the operation showed many leucocytes and pus cells and a large number of diplococci, kidney-shaped, mainly within the cells, and in some cases present in large numbers. A few were comparatively free, and they resembled in appearance gonococci. They did not stain by Gram's method. There are no conveniences or apparatus here for attempting cultures, so this was not done.

The patient showed no signs of gonorrhœa and denies an attack, and certainly has not gleet, though his word may not be trustworthy, yet at present no sound has been passed to find out if he has an ulcer or slight stricture on account of his serious condition, but the passage of his urine is easy and complete, and there has been no pus or albumin in his urine.

Microscopical examination shows the cocci to be either gonococci or cocci practically indistinguishable from them, and for this reason the case is worthy of notice.

SALTS OF CALCIUM IN FUNCTIONAL ALBUMINURIA.

By Captain A. O. B. WROUGHTON.
Royal Army Medical Corps.

Wright and Ross have pointed out (*Lancet*, October 21st, 1905) that functional or physiological albuminuria may, in some cases, be due to diminished blood coagulability, and they record six cases in which the administration of calcium lactate was followed by disappearance of the albumin. According to these observers, the administration of calcium salts has no effect in organic albuminuria, and their administration is therefore an aid in the diagnosis of these disabilities. The following case appears to corroborate the foregoing remarks.

Private B., 2nd Dorsets, aged 22, was detained on August 27th, 1907, with a mild attack of ague; temperature, 99° F. He complained of feeling cold and was put to bed; an aperient was given which acted well, and he was then given quinine, 5 grains, with phenacetin, 3 grains, and caffeine, 1 grain. His temperature rose that evening to 101·4° F., when he broke out into a profuse perspiration, and the temperature began to fall and was normal by the middle of the next day, the 28th, on which he was admitted, his urine being found to contain a considerable amount of albumin.

Examination on Admission.—Well nourished, though pale and rather anæmic. Nothing abnormal found in thorax or abdomen, although he complained of pain in the splenic region, which was rather tender. No œdema anywhere, or puffiness under the eyes; no headache or retinitis; bowels regular; tongue slightly furred. Urine: sp. gr. 1020, acid, perfectly clear but rather high coloured; no sediment or sugar but a considerable amount of albumin. To make quite sure there was no contamination, I prepared a catheter myself, and drew off a specimen from the bladder; the albumin was the same as in the previous specimen.

Treatment.—He was kept absolutely in bed, on a plain milk diet, and given a diaphoretic mixture, t.d.s.; locally, glycerine and belladonna, spread on lint, placed over the painful splenic area, and dry heat applied over this.

Previous Illnesses.—A mild attack of measles when a child, and two or three mild attacks of malarial fever since coming to India. He was admitted to hospital here about a month ago with malaria, and a specimen of his blood sent to the Divisional Laboratory for examination, before the administration of quinine; no parasites were found. There was no albumin in his urine at this time.

Progress of Case.—On the 29th, the second day of admission and the third of observation (he was detained the first day, 27th), the temperature was found to be normal and the pain in the side was much better. Urine: the same amount of albumin present, the quantity of urine passed in the previous twenty-four hours being 28 ounces. The same treatment was continued.

On the 30th, the fourth day of observation, the temperature was normal, and pain in the side quite gone. The urine showed the same amount of albumin as on the preceding days; 32 ounces were passed in the preceding twenty-four hours.

I now put him on calcium chloride, 5 grains, t.d.s. (the lactate was not procurable). The next morning, the 31st, the albumin was much less, and the evening specimen did not show the slightest trace; 52 ounces of urine were passed in the last twenty-four hours.

During his stay in hospital his urine has been tested twice daily, both by boiling and with nitric acid in the cold, and, till the administration of calcium chloride, the amount of albumin present was the same at each test, and considerable in quantity.

I venture to think this an interesting case of functional albuminuria: (*a*) because of the absence of any sign of nephritis, there being no œdema anywhere or puffiness under the eyes, and no headache, vomiting or retinitis; in addition, the absolute clearness of the urine, no casts or shreds of any kind being present; (*b*) his healthy past history; and (*c*) the rapidity with which the albumin disappeared on the administration of calcium chloride.

September 2nd.—Patient's urine still absolutely free from albumin.

I hope to make some further investigation into this subject, and am examining all the specimens of urine I can get, and hope to give this treatment further trial.

CASE OF RUPTURED ECTOPIC GESTATION. LAPAROTOMY AND RECOVERY.

By Captain M. M. LOWSLEY.
Royal Army Medical Corps.

Mrs. D., aged 29, was admitted to the Louise Margaret Hospital on the afternoon of June 10th with the following symptoms:—She has two children, the youngest 1 year and 10 months. In September, 1904, she had a miscarriage. Her menstruation has always been regular, and she has not suffered from dysmenorrhœa. She menstruated last on March 18th (so was just under three months pregnant). At 11 p.m. on the night of June 9th, when walking from the railway station to her home (a distance of less than ¼ mile), and carrying a fairly heavy parcel, she was suddenly seized with a very severe pain in the lower

part of the abdomen on the right side and a desire to pass water. She managed to reach her home with difficulty, and at once went to the w.c., where she fainted. She soon recovered, and with her husband's help walked upstairs to her bed. As she is "off the married strength" and was living in the town, her husband went to a civilian doctor; he did not at the time think there was much the matter with her, because a few months previously she had had an attack resembling appendicitis, and under treatment had got quite well in a few days. He went to the same doctor who had attended her on that occasion, and told him that she had a similar attack, and that if he would give her some of the same remedies there would be no necessity to see her that night. The doctor gave him something to sprinkle on to hot fomentations to be applied to the painful part. The next morning when the doctor saw her he found her very ill and advised the husband to take steps to get her admitted to hospital. She gradually got worse, and in the afternoon her husband went for the orderly medical officer, who saw her at her house with the civil practitioner, and being of the opinion that it was a case of ruptured tubal pregnancy, he sent an ambulance to take her to the Louise Margaret Hospital, at the same time sending a note to me (as I was temporarily in charge of that hospital during the absence on leave of Lieutenant-Colonel S. Powell, R.A.M.C.), asking me to see her as soon as I could. I saw her on her arrival there at 4.30 p.m. She was then extremely blanched and had evidently lost a great deal of blood. Her pulse was 140 and very weak. Temperature subnormal. She complained of great pain in the abdomen, which was distended and very tender, and there was dulness in both flanks. I made a vaginal examination, but beyond the fact that the rectum was loaded with fæces, nothing definite could be made out. There was no discharge. I came to the conclusion that she had a ruptured extra-uterine pregnancy and that immediate operation was necessary. I ordered an enema to be given and the abdomen to be prepared for operation as quickly as possible. When the nurse was giving the enema the patient had a convulsion, and Lieutenant W. I. Thompson, R.A.M.C., the orderly medical officer, told me that she had a similar convulsion at the time he saw her in her own house.

At 5.30 p.m., with Captain S. G. Butler, R.A.M.C., to assist me, I performed the operation. The patient's bladder having been emptied, she was put in the Trendelenburg position, and I opened the abdomen by a 5 inch incision through the right rectus muscle. As soon as the peritoneum was opened blood flowed out, and having removed a large quantity of clot I found a tumour about the size of a duck's egg, from a rupture in the upper surface of which blood was oozing; this tumour was attached to, and apparently one with, the uterus. Whilst examining it, it burst, and the fœtus with about 2 or 3 ounces of amniotic fluid escaped; it was then at once apparent that it was an interstitial ectopic gestation. Owing to the condition of the patient, it was necessary

to complete the operation as rapidly as possible. I removed the right tube and ovary, cut away as much of the sac as I could, and then stitched up the cavity in the uterine wall. As much of the loose clot as possible was removed, 30 ounces of normal saline solution were put into the abdominal cavity, a strip of gauze to act as a drain inserted, the external wound closed, the peritoneum and rectus muscle were included in one layer of sutures, and the skin brought together by a separate layer of stitches. During the operation, which lasted about twenty-five to thirty minutes, Lieutenant Thompson, who was giving the anæsthetic, had also given a subcutaneous injection of normal saline solution. When she was taken off the operating table her condition was extremely grave, her pulse being 146 and very weak. Her face had a pinched expression, and we had very little hope of her recovery. She was at once got to bed, surrounded with hot-water bottles, and a hypodermic injection of strychnine and digitalis given. I ordered her to be given a pint of saline solution by the rectum every two hours and a nutrient enema every four hours. Nothing but warm water in small quantities was given by the mouth. I saw her again at 9.30 p.m.; she was then quite conscious, but complained of great pain in the abdomen, and her pulse was 140 and rather stronger. I gave her $\frac{1}{4}$ grain of morphia hypodermically.

The next morning she said she felt much better; she had slept fairly well after the injection of morphia, and at the time I saw her had very little pain; the pulse was still 140, but improving in strength, and a tinge of colour had returned to her lips. Temperature subnormal. As a considerable quantity of fluid had drained away and completely soaked the dressings, these were changed. There had been very little vomiting from the anæsthetic and it had completely ceased for some hours, so I began to feed her by the mouth with small quantities of milk and beef-tea with brandy; these were gradually increased, as it was found they were well borne; the saline injections and nutrient enemata were continued for that day and then stopped. She steadily improved and the wound was dressed when necessary, as the dressings became soaked; on the third day I began to gradually withdraw the gauze drain; on the sixth day after the operation it was completely removed and the stitches taken out; and on the ninth day the wound was completely healed except for a small sinus where the drain had been. Up to this time the temperature had never been over 99·8° F. On the morning of the third day after the operation there was a slight blood-stained discharge from the vagina, and this still continued. On the tenth day after the operation the temperature rose to 100·4° F. and became of a hectic type; in spite of this the patient said she was feeling better every day and complained of no pain. She was taking plenty of nourishment, and was having 4 ounces of brandy and 8 ounces of champagne in the twenty-four hours. On the fifteenth day the vaginal

discharge ceased. The sinus in the abdominal wound was almost closed and there was no discharge from it. On palpation a large, hard mass could be felt in the lower part of the abdomen rather to the left of the middle line; this gradually became less. On vaginal examination a large boggy swelling could be felt in the pouch of Douglas. The improvement in her general condition continued, but there was still the rise of temperature, and the pulse-rate continued high.

On June 30th I handed over the case to Lieutenant-Colonel S. Powell, who had returned from leave, and to him I am indebted for the subsequent notes on the case. On July 6th, twenty-six days after the operation, she began to menstruate; the period lasted six days and was quite normal. On July 21st there was a slight purulent discharge from the vagina, which was followed the next day by a fairly profuse serous discharge, and the day after that, what was apparently the decidua was passed. From this time the temperature, which till now had been irregular, fell to just below normal and remained there. The mass in the pouch of Douglas became rapidly less, and when she left hospital on August 15th had entirely disappeared—in fact, with the exception of slight fixation of the uterus, nothing abnormal could be made out.

Remarks on the Case.—This was a case of interstitial ectopic gestation, which is the least common form, and it had almost reached the end of the third month; the amniotic sac had not ruptured, but there was a rupture in the tube at its junction with the uterus, which was still bleeding eighteen hours after the occurrence of the first symptoms of rupture. The convulsive attacks which the patient had were very alarming, and I think must have been due to cerebral anæmia. The decidua did not come away till forty-three days after the operation, although the patient menstruated on the twenty-sixth to the thirty-first days, and this menstruation was apparently normal.

My thanks are due to Captain S. G. Butler, R.A.M.C., who assisted me at the operation, and to Lieutenant W. I. Thompson, R.A.M.C., who gave the anæsthetic.

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DIFFICULTY IN DIAGNOSIS.

By Lieutenant-Colonel J. R. Forrest.
Royal Army Medical Corps.

The case mentioned below is chiefly remarkable for the difficulty experienced in arriving at a diagnosis. The man had not had syphilis. He was in hospital with "soft chancre" from February 28th, 1906, to March 30th, 1906, but has had no secondary signs. He has been invalided because he is unable to fully extend his left elbow-joint.

The patient, No. 26,770, Gunner G., 4th Battery Royal Field Artillery, states that about one year before enlistment (September 10th, 1902) he

To illustrate "Difficulty in Diagnosis."
By Lieutenant-Colonel J. R. Forrest, R.A.M.C.

suddenly had pain in the left elbow-joint and was unable to fully extend his arm (at Birmingham).

The skiagram shows the whole of upper end of ulna, including olecranon and coronoid processes, to be enlarged; the shaft is thickened, and the joint appears to be encroached upon. Chest normal; no enlarged glands.

Diagnosis would appear to be between: (1) Osteoma, cancellous, and from the history of the case probably congenital, but the shaft is enlarged also; (2) tubercular disease of upper end of ulna, probably deep seated and of long duration, and leading to osteo-sclerosis of the shaft from continued irritation; (3) sarcoma (central) of ulna. From the skiagram the joint appears to be encroached upon, which would be particularly significant of myeloid sarcoma. The glands are not affected as they would be in round-celled sarcoma; moreover, the growth has obviously been very slow.

TWO CASES OF BLACK URETHRAL DISCHARGE.

By Captain A. C. OSBURN.
Royal Army Medical Corps.

In July, 1906, two patients were admitted to the Station Hospital, Agra, suffering from a dark brown urethral discharge. They admitted exposure to the risk of venereal disease. On the day after admission, both men complained of a tender spot about halfway down the urethra. The discharge was nearly black, scanty in quantity and was at times inky black. On examination microscopically the discharge was found to consist of a mass of what at first appeared to be mis-shapen spermatozoa mixed with a few doubtful-looking gonococci, but several more careful examinations showed the discharge to be full of a branching fungus, with numerous spores resembling *Aspergillus niger*. The ordinary injections and treatment for gonorrhœa having very little effect, some urethral injections of hydrarg. perchlor. 1—2,000 were tried, when the discharge speedily became clear and colourless, and rapidly disappeared.

NOTES ON A CASE OF ENTERIC FEVER WHICH HAD RECEIVED A FIRST DOSE (0·5 cc.) OF ANTI-TYPHOID SERUM.

By Captain W. S. CROSTHWAIT.
Royal Army Medical Corps.

Previous History.—Private S., 1st Essex Regiment, was given a first dose of anti-typhoid serum by Captain L. Cotterill, R.A.M.C., on July 30th, 1907, and came sick suffering from fever the following day. Has never been inoculated against enteric before, and has never had the

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disease. Is not a teetotaler, and never goes into the bazaar. Enteric fever has been prevalent in this regiment for some time, and there have been more cases in his company (D) than in any other.

Progress of Case.—Patient's temperature when he came sick was 102° F., and, although not high at any time (during the first attack of pyrexia), did not fall to normal until August 15th, 1907. His spleen could not be felt, and except for the continuous temperature there were no definite symptoms or physical signs of enteric. Temperature remained normal until the evening of the 17th, when it suddenly rose, with a rigor, to 103·2° F.; pulse 80. He complained of frontal headache, and had a dull, heavy look.

On August 19th a few typical rose-spots appeared on the abdomen, and they continued to come out in crops for several days; odour peculiar to enteric also noticed.

On August 23rd there was consolidation of the base of the right lung; pulse dicrotic, and stools were typical. A few days afterwards the physical signs of pneumonia of the left base were detected.

On September 4th the morning temperature was normal for the first time.

The points of interest in this case appear to me to be: (1) The fact that the patient had had a first dose of the anti-typhoid serum immediately before going sick; (2) the mild course of the primary attack of pyrexia and the apparent absence of the usual clinical signs of enteric (with the exception of a continuous temperature); (3) the temperature being normal for two days and then suddenly rising, with a rigor, to 103·2° F.; (4) typical enteric spots appearing on the third day of the second attack of pyrexia and their absence in the first attack.

The questions one might ask oneself are: Was the primary attack of fever true enteric? and if so, was it modified by the first dose of anti-typhoid serum the patient had been given? Widal's reaction, during the second attack of pyrexia, gave a positive result.

NOTES FROM MOUNT ABU, RAJPUTANA, ON SOME INTERESTING CASES.

By Major F. KIDDLE.
Royal Army Medical Corps.

Spurious Myopia.—Patient was sent from Mhow for examination of vision. Subjectively he could only read the Snellen's type, D = 60, at 3 metres. With concave spheres he was improved to $\frac{D}{24}$, both eyes Retinoscopy, under homatropine and cocaine, revealed compound hypermetropic astigmatism in each eye, and the following glasses improved him at once to $\frac{6}{6}$ in each eye:—

Right: $\dfrac{+\ 1{\cdot}25 \text{ D. sph.}}{+\ 0{\cdot}25 \text{ D. cyl.}}$ axis vert. Left: $\dfrac{+\ 0{\cdot}75 \text{ D. sph.}}{+\ 0{\cdot}50 \text{ D. cyl.}}$ axis vert.

Forty-eight hours later, when effects of mydriatic had passed off, he could read the smallest types with the above glasses comfortably, after deducting 0·25 d. sph. from the right combination. On the same occasion he could read the types D = 12 at 6 metres without the aid of glasses.

Retino-Choroiditis complicated by Optic Neuritis.—Patient was sent from Belgaum with a report that the vision of his left eye had suddenly failed, so that he had only perception of light in it. The patient's age was 23 years, and no history of any illness or other likely cause could be furnished, beyond the fact that his father went blind at the age of 49.

His condition on admission was: Vision of right eye $\frac{6}{6}$; of left reduced to P. L. Externally, there was nothing to note about the right eye, but in the left the pupil was very sluggish to light and was semi-dilated; on the back of the cornea numerous opacities were visible. Ophthalmoscopically the right fundus appeared quite normal, except below and to the outer side of the macula, where the remains of a large hæmorrhage could be seen; this was so near the periphery that even with the pupil fully dilated it could only be seen with difficulty. In the left eye a very interesting condition was seen. The optic papilla was very inflamed, the blood-vessels being almost invisible, but where seen the veins were much engorged. To the outer side, just above the macular region, a patch of old choroiditis was seen, but owing to the turbidity of the vitreous nothing more definite could then be made out.

Under treatment the optic neuritis rapidly improved and the media cleared up, leaving a few large opacities. It was then seen that there were also patches of old choroiditis round the fovea itself, thus accounting for the loss of vision. The dilatation of the pupil disappeared, but the iris responded to light stimulus very sluggishly; the opacities at the back of the cornea quite cleared off except one that was a little larger than the others.

This case is of interest on account of the absence of symptoms, as far as the patient was concerned. Till a week before admission to hospital he had perfect vision in each eye, *he states*, as he had been firing a course of musketry and had aimed a few shots with his left eye. This statement, however, appears hardly compatible with the condition of affairs found in both eyes, the patches of choroiditis being undoubtedly of old standing.

Abscess of Liver.—Patient was sent from Nasirabad for change of air, in December, 1906. His medical history sheet showed that he had suffered from abscess of the liver the same month, but had recovered without either expectorating or getting rid of it otherwise, or having it relieved by operation.

In March, 1907, he was admitted suffering from inflammation of the liver with pneumonia of right base. As his condition did not improve as well as expected, it was determined to explore the liver for pus, but the very night previous to the operation he commenced to expectorate pus in

large quantities. It came from the right lobe. Patient at once improved, and was discharged to attend on June 13th.

At the beginning of July he caught a cold and was at once readmitted. The left lung was found to be consolidated at the base; liver enlarged a little to the left. The pneumonia increased rapidly till nearly the whole lung became involved. This then improved and the lung cleared up, except at the base. The sputum, which had become very scanty and purulent, then suddenly became very sanguineous and again contained a large quantity of "liver" pus, pointing to the fact that another abscess had burst through the diaphragm into the left lung, Matters progressed exactly as before and the patient made a good recovery, but as he was naturally much debilitated in consequence of so long and severe an illness, he was brought before an invaliding board and recommended for discharge.

Appendicitis occurring during the Puerperium.—Two attacks occurred in the same patient at an interval of three years (first and second child), and a third case occurred recently in another primipara. All the attacks came on about the same time, viz., the sixth day after the birth of the child. All the labours were quite normal and the after-results perfectly natural till, in each case, about the sixth day, the patient was seized with agonising pain in the umbilical region, which spread rapidly to the right iliac fossa, the maximum tenderness being at McBurney's point. A swelling formed in the iliac fossa, and was very tender to pressure. Temperature, which, till attack, had been normal, rose in each case to 100° to 101° F., and remained about this for three or four days, when it slowly subsided. At the same time the pain began to diminish and the swelling to get less, till, in about two weeks time, all abnormal conditions, save a little thickening in the iliac fossa, had disappeared.

All these cases were on a "slop" diet at the time of attack, and till the sudden onset had been progressing well in every way. The lochia were normal throughout, and the involution of the uterus was not affected in any way.

Treatment consisted in absolute rest, whey and milk. Bowels kept clear with small enemata till castor oil could be safely given.

A SUGGESTION FOR THE CANCER RESEARCH COMMITTEE.

By Lieutenant-Colonel F. J. JENCKEN.
Royal Army Medical Corps.

I see in the daily papers, and also in the *British Medical Journal* for May 18th, 1907, p. 121, that Professor Wolfram C. Fuchs, of Chicago, has died of cancer, induced, it is believed, by continual exposure to the X-rays. The disease began in the hands, and finally attacked the trunk and internal organs. It is further stated that other deaths have taken place from the same cause.

This recalled to my mind an impression which had existed previously, of the close connection that exists between certain classes of epitheliomata and injuries induced by burns. Cancer of the lips was well known to be connected with chronic irritation of the lips caused by a hot clay pipe. "Chimney sweep's" cancer was often the result of constant irritation of the scrotum from hot ashes, when chimney sweeps carried the bag close to the legs. In Kashmir the inhabitants all wear one big garment reaching to the ankles, and in the cold weather they keep themselves warm by placing an earthenware vessel (*kangri*) filled with glowing charcoal under the gown. They often fall asleep with the *kangri* still alight, and the vessel often gets upset from involuntary movements during sleep. The result is that most of the inhabitants of Kashmir are the subjects of more or less extensive burns, and epithelioma is very common in the cicatrices. Of course, the connection I refer to may be merely that the vitality or resisting power of the cicatricial tissue is lowered, thus rendering it an easier prey to the cancer microbe (if any). But considering the difficulty that has so far been found in cultivating a microbe, may it not be that, perchance, the microbe, if it exist, may require the application of long-continued high temperature for its development? It would be interesting to know if there are any statistics showing the proportion of cases of cancer of the os or cervix uteri which have occurred subsequent to cauterisation of those parts.

UNUSUAL SEQUELA OF CHRONIC EAR DISEASE.

By Lieutenant-Colonel F. J. JENCKEN.
Royal Army Medical Corps.

Private ——— was admitted to the Station Hospital, Deolali, March 6th, 1907, with fever. As he had been admitted before with ague due to the malignant tertian parasite, it was thought that his temperature was due to malaria, but no parasite was found in his blood. A few days after his admission he began to complain of pain and stiffness in the back and right side of the neck, and the chain of glands appeared enlarged. The right side of the neck then appeared to become swollen. On enquiry, the fact was elicited that he had had a discharge from the right ear since childhood, following upon scarlet fever. After this the swelling became more pronounced and, thinking there must be suppuration in connection with the mastoid cells, on March 16th I made a long incision behind the ear, exposing the mastoid process, but failed to reach pus. His condition became worse, and the swelling of the neck increased, spreading even over the chest and to the other side of the neck. I therefore incised the swelling over the right side of the chest, which had rapidly increased in size, and let out several pints of stinking pus. The abscess cavity, which extended right across the chest, was irrigated, and

when the pressure in the cavity rose, pus was seen welling out of the external meatus of the ear, so that the pus must have worked its way along the vessels beneath the deep fascia to below the clavicle. His condition at the time of the second operation was very critical, and a day or two afterwards a counter-opening had to be made on the left side of the chest; but after this he gradually improved, the discharge diminished and became less fœtid, his appetite improved, and he gradually made a good recovery.

Reprints.

THE PRESENT-DAY TREATMENT OF SYPHILIS IN ENGLAND.[1]

By Colonel F. J. LAMBKIN.
Royal Army Medical Corps.

During the last twenty years the treatment of syphilis has made much progress on the Continent of Europe and in the British Army both at home and abroad. Does this apply equally among the civil population of the United Kingdom? This will be the subject for consideration in the following paper:—

It is convenient to divide the subject of the treatment of syphilis into three parts: (1) Hygiene (including the important question of the increase and maintenance of tissue metabolism); (2) the administration of the specific, mercury; (3) the employment of auxiliary measures, such as iodide of potash, &c.

The consideration of all these elements opens up a very large question, too large for the scope of this paper, hence it is proposed to limit discussion to the second—*i.e.*, the modes of administration of mercury. Before discussing this, it will be necessary to inquire what the teaching is in England to-day as to the actual practical treatment of the disease. This can best be studied at the out-patient department of any of our large hospitals, as it is seldom that patients suffering from syphilis, plain and simple, are admitted as in-patients to any of these institutions. We are taught there to treat the symptoms and lesions of it which may be present, but too often, on the disappearance of these, the patient ceases to come to hospital, consequently treatment is suspended, and is not resumed until fresh manifestations render it necessary. Should these latter be so mild as to cause little inconvenience or disfigurement, the patient probably receives no further treatment, as he may not present himself until he is affected with something more serious in the shape of, say, cerebral or

[1] Reprinted, by kind permission, from *The Hospital*, June 29th, 1907.

spinal paresis. The fact is that the treatment of syphilis is aimed more at obliteration of apparent symptoms than at an actual cure. This may not be the teaching as expounded at the medical schools, but it is what one sometimes sees in practice at their clinics. What we learn at the hospitals in England is to ameliorate and not to cure the disease. It is an easy matter to disperse the symptoms and lesions of syphilis. For as soon as their cause is diagnosed, all that is necessary is to apply that remedy which we know and trust so well—mercury—and they disappear. But it is an entirely different thing to treat the disease with a view to eventual cure or prevention of untoward symptoms.

But in the face of what we now know to be necessary as regards the treatment of syphilis, and on which all syphilologists of the day are agreed—*i.e.*, to cure the disease and to prevent its remote effects upon the patient or his posterity—it is absolutely necessary that treatment should be carried out over a lengthened period, with a minimum of eighteen months, by some plan or other, be it continuous, chronic-intermittent, or preventive.

Further, most authorities are agreed that syphilis needs to be attacked not only during its eruptions, but also in its quiescence; hence, whatever system of treatment is established, it is necessary that it should be of long duration. It should always be remembered that syphilis is a chronic disease or diathesis requiring chronic treatment. It is not on such lines as these that the system of treatment which we see carried out at our great hospitals is founded. On the contrary, what exists there not only makes no attempt at curing, but what is possibly still worse, does not even prevent further and permanent trouble.

In the way of argument, I have heard it stated over and over again that what we see of the treatment of syphilis at a hospital is not to be taken as an example of how the disease is treated throughout the country generally, and that quite a different state of affairs exists in private clinical practice. A unique experience on both sides of the question unfortunately, makes me think otherwise, and forces me to the conclusion that, as regards the treatment of syphilis in civil life in the United Kingdom there is little difference in the way it is carried out between that in vogue in the hospitals and in private practice. After all, "as the twig is bent, so will it grow," and the student who has been accustomed to see the disease treated at the hospital in a certain manner will be at least prone to continue the same method when he enters private practice. From my experience I unhesitatingly say that in ninety-nine cases out of a hundred in England at the present day the system of treatment which is carried out is much what we see it is at our large hospitals, as above described. In other words—and there is no good our blinking at the fact—the treatment of syphilis in England at the present time is one of symptomatic amelioration, and, generally speaking, no real attempt is made to deal with the disease in the only possible way of doing so, if any hope is

to be held out of an eventual cure, *i.e.*, of establishing some system by which treatment can be carried out with as little doubt as possible over that lengthened period which we know to be necessary; and in this respect, the conclusion I have come to is, that at the present day the treatment of syphilis in the United Kingdom, among the civil population, has not kept pace with what has been done during the last twenty years on the Continent and in the British Army. This conclusion I have arrived at from what I have personally seen of the treatment of the disease in civil life, at the clinics of the largest hospitals in England, as compared with that adopted generally in Germany, France, Italy, and at the syphilitic clinics of Paris, Berlin, and Milan, added to my knowledge of the advance the treatment of the disease has made throughout the British Army in all parts of the world.

The question is, What are the causes or factors which have probably or possibly led to this state of things? Personally, I do not think one requires to seek far to find them. To my mind the following are the principal causes: (1) Neglect to bring syphilis within the Infectious Diseases Notification Act; (2) the non-adoption in England of the more modern method of administering specific treatment. There are other possible causes of minor consequence. As regards the first of the two main causes, it was a very great mistake that syphilis was not included in the Infectious Diseases Act. I have always thought that the medical profession in England were responsible for this omission. They should have insisted upon this point. One Royal Commission has strongly recommended the inclusion of syphilis in the Notification of Diseases Act, but the profession has not supported its recommendation.

One of the chief causes which has been put forward by the profession for not carrying the treatment over a lengthened period, is that the uneducated classes in England cannot be made to see the necessity of further treatment after the disappearance of the symptoms of the disease. This is the reason why syphilis should be included in the Act. Patients would then be eager to get cured, and if they failed to present themselves for treatment would be compelled to do so. The insuring of better treatment means decrease in the amount of disease—lunacy, general paralysis, tabes, and other diseases due to syphilis—but it would also act as a real check on the spread of the disease, and probably ultimately stamp it out. We are told that eventually education will do for the treatment of syphilis everything for which this Act is proposed, without its enactment; but I fear we should have to wait many a year before seeing education reach this mark in England.

When the old C.D. Acts required upholding the medical profession entered into the fight with all its energy, and brought all its great influence to bear on the matter; yet this Act was one of pure prevention, whereas the Notification Act aims also at cure. The question at issue is one of political economy, one affecting in the most serious manner the

health of the nation, and as such is surely worthy of the gravest attention of the medical profession. We cannot help feeling convinced that the fact of making syphilis a notifiable disease would be of infinite value to the nation at large.

In considering the second cause—*i.e.*, the non-adoption of the more modern modes of administering specific treatment—I am aware that I am treading upon tender ground. I shall probably be told that I am advocating one particular method because I am prejudiced in its favour, or that the reason why these methods have not been adopted is because experience in England is against their employment; but the question at issue is not one of a comparison as to the relative advantages of one method over another as regards their respective therapeutic effects on syphilis, but it is one, the essence of which is: (1) Which of all the known methods of administering mercury will enable us best to continue treatment over that length of time which we know to be absolutely necessary to effect a cure of syphilis, and in any case act as a preventive of its near and remote consequences? (2) By which of the known methods can we do this with the greatest certainty and regularity, and with the least inconvenience to our patients?

It will suffice here to mention the three principal modes by which mercury is introduced into the system: (1) The internal, ingestive, or stomachic method; (2) the inunction method; (3) the intra-muscular injection method (in speaking of which I mean always that of the insoluble salts of mercury). The internal method is the one which is generally employed in England—in fact, it is the favourite method in at least 90 per cent. of the cases under treatment. By this mode of medication mercury is introduced as pills or powders, mixtures or syrups, for absorption either by the stomach or intestines. The technique of this particular method has varied but little as years have gone on, except in the form of the salt of the metal which has been employed. At the present day the most popular forms are the original salts—namely, bichloride and protoiodide, calomel and metallic mercury. Each has its own admirers, and each is favoured in one country more than another; bichloride and protoiodide being generally used on the Continent, whilst on the whole metallic mercury is most favoured in England. Of late years calomel has become more or less discredited, owing to certain accidents which followed its use.

In England metallic mercury, being most favoured, is generally given in the form of a pill or powder, one of which is ordered to be taken two, three, or four times a day, as the case may be. Bichloride, when employed, is given in mixture or syrup. In this case it is very often combined with iodide of potassium, and forms a staple mixture to be found in almost every dispensary in the country. On the Continent bichloride and protoiodide are the favourite salts, and as such are given in the form of pills under the name of Dupuytren's or some modification

of them—one pill to be taken from two to four times a day. The average dose per day of the bichloride is ½ grain for a man, ⅓ grain for a woman. France, especially Paris, is the home of protoiodide, where it is a general favourite. It is given in pills two to four times a day, with an average daily dose for an adult (male) of 1½ grains; half of that dose for a woman. Both of these salts have their admirers and adherents, who claim for them certain advantages.

The following appears to be the general consensus of opinion concerning them. Protoiodide is better tolerated than bichloride, hence its dose can be raised with greater safety than in the case of the latter; it affects the gums sooner, but is less likely to salivate than bichloride; it is more likely to affect the intestine than the stomach, and often brings on diarrhœa. It benefits early secondary symptoms more than later lesions. Bichloride is not so well tolerated as the former salt, and it becomes dangerous to raise its dose above 1 grain per day. It affects the stomach rather than the intestines, and is very apt to cause gastritis and also a painful condition called sublimate gastralgia. It ought not to be continued for longer than a few weeks at a time on account of its known effects on the stomach. Bicholoride has most effect in the later secondary and tertiary stages. On the whole, although nothing definite is settled, preference is generally given to the protoiodide.

These are the chief ways in which mercury is administered by the ingestion method, and the salts described are those usually employed; besides them, it will be only needful to mention here a few of the principal modern salts of mercury which have during the last few years been introduced with the supposed advantage of being free from some of the disadvantages of the older salts, such as not causing stomatitis, salivation, diarrhœa, or gastritis. The following are the salts: Tannate, salicylate, and sozoiodol of mercury. I do not believe that any one of these has proved itself better than the older salts, on which most practitioners have to fall back.

The next method of administering mercury is that by inunction. This is the oldest method of all, but has never been used in England in such a general way as the one just described. It was in full use with us in the fifteenth century, and John Hunter, in speaking of the ways of introducing mercury into the system, says: "When it can be thrown into the constitution with propriety by the external (inunction) method, it is preferable to the internal, as the skin is not nearly so essential to life as the stomach." It is probable that had more attention been paid and importance attached to the details of this method in England, it would still be flourishing. As its entire success depends upon the manner in which this is done, and as it has been almost entirely ignored in this country, of late years this special form of treatment has not held its own except in a few institutions. The Mecca of the inunction method is Aachen, where it has flourished for the last century and a half, and where it is done to perfection.

At the Military Hospital, Rochester Row, London, the external method is carried out as follows: (1) First a rubber is necessary, and for this purpose orderlies are educated; (2) before inunction is performed a hot bath is given for twenty minutes; (3) the following formula is used for the mercurial preparation:—

Ung. hydrarg.	50 grs.
Lanolin, hydros.	25 ,,
Adipis benzoin	25 ,,

Divide into two parts and wrap in wax paper.

Both parts are handed to the rubber. The regions of the body rubbed are changed daily so as to avoid the effects of friction. They are, in succession: First day, arms; second, forearms; third, thighs; fourth, calves; fifth, back; sixth, chest. Each rubbing lasts from twenty to twenty-five minutes. It must be done slowly and evenly, with a good deal of pressure. The part, after being rubbed, if properly done, ought to look as if black-lead had been used—shiny, but not greasy. The best time for inunction is in the morning, as the movements caused by exercise favour absorption. The part rubbed on any one day is not scrubbed until the morning prior to its being again utilised. During the course of rubbing the usual strict attention is paid to the hygiene of the mouth and gums, and close watch kept on the condition of the urine and body weight. A course consists of forty rubbings. How different is this procedure from that which one sees taught and carried out in this country, where we learn that to do it correctly it is sufficient to tell the patient to take a piece of mercurial ointment the size of a hazel nut on the top joint of the index finger and to rub this into the groin or calf of the leg before going to bed. That sort of inunction fails, and is dropped.

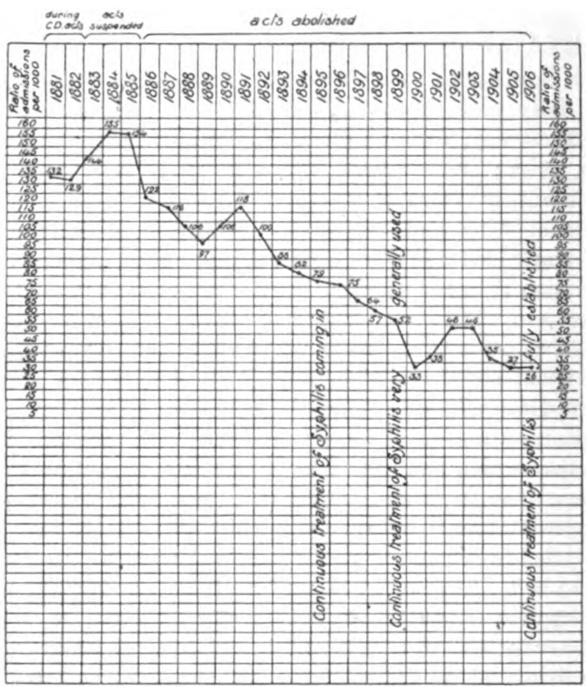
There are grave objections to this method. First, it is difficult to carry out efficiently, except in a hospital. Second, it is dirty, repugnant and compromising, as it stains linen, and servants and washerwomen soon get to know what is going on. A third objection arises from its effects—namely, stomatitis and mercurial dermatitis of a severe nature being often associated with it.

Intra-muscular Injection.

The third method of administering mercury is by intra-muscular injection. This was first introduced by Scaranzio, of Pavia, in 1864, but although therapeutically a success, it had to be abandoned, owing to the number of accidents that accompanied it, such as abscesses. The accidents were undoubtedly due to the absence of antiseptics at that period. The method was reintroduced by Smernoff in 1882, with very little better success, and was again dropped. It was finally brought forward in 1887 by Balzar, under more favourable circumstances as to antiseptics, better preparations of mercury, and a more suitable vehicle for the suspension of the latter. The technique of the treatment by this

method was gradually improved until accidents, such as abscesses, which formerly appeared to be an invariable accompaniment of the treatment, disappeared. Little by little this method worked its way into favour, until now on the Continent it is by far the most popular way of introducing mercury into the system.

United Kingdom.



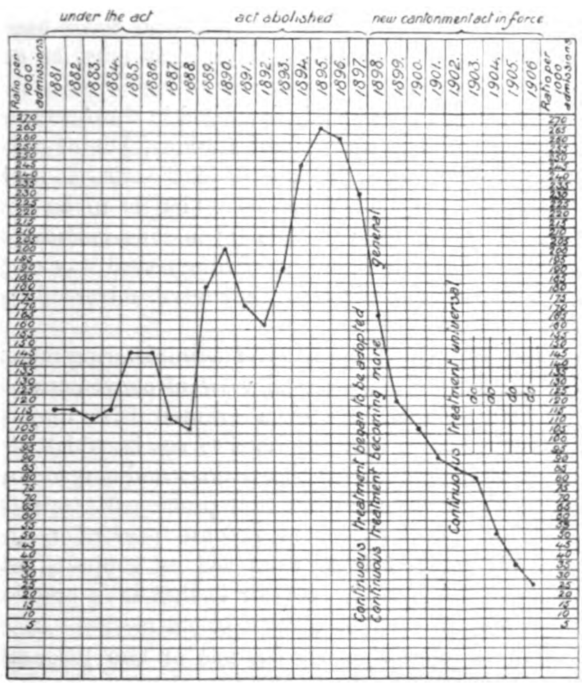
I introduced the intra-muscular method into the British Army in 1890.[1] There it had to contend with the usual dislike of the Britisher to innovation, and had to fight hard before it caught hold and became popular. At the present day it is the method adopted throughout the Army both at home and abroad, and is recognised as the only means by which the cure and prevention of syphilis can be effectually carried out. As such it has proved itself a boon, as can be gathered from the accompanying charts.

A certain number of accidents were recorded during the first years of its introduction, but with improved technique these have long since become a tale of the past. I have published a record of 70,000 injections

[1] See "The Treatment of Venereal Diseases and Scabies in the Army, 1904." Advisory Board for Army Medical Services, First Report, 1904, p. 28.

(nearly all metallic mercury) without a single mishap (*British Medical Journal*, November, 1905). During the last two years at the Military Hospital, Rochester Row, London, no fewer than 11,000 intra-muscular injections have been given, with a total absence of any accident. I have no intention here of entering into the technique of the intra-muscular method. Suffice it to say that in the Army the insoluble salts of mercury are for several reasons preferred to the soluble, and of these metallic mercury is the form which is generally used. The insoluble salts need be injected only once a week, whereas if the soluble salts are used a daily injection is required.

British Forces in India.



The Plan Adopted.

On the syphilitic patient becoming sick, he is placed on a syphilis register, and provided with a case-sheet upon which is entered his previous history and present state. Whenever he attends the treatment is entered on his sheet. A course of six weeks' energetic treatment, usually in hospital, is given, which involves six mercurial injections. On finishing this course the patient is allowed an interval of two months without any treatment, but during that time is inspected once a fortnight.

Should he remain free from syphilitic manifestations for two months he is then ordered a further course of four injections once a fortnight. If fresh symptoms appear, a second course of six injections weekly are given, followed by a two months' interval. If free from signs of the disease, the next interval is increased to four months, followed by a course of four injections. The succeeding interval may be increased to six months, followed by four injections, one each month.

In a tabular form the above reads :—

Six weeks' treatment : Six mercurial injections. Two months' interval.
Two months' treatment : Four injections. Four months' interval.
Two months' treatment : Four injections. Six months' interval.
Four months' treatment : Four injections.
Total, twenty-one and a half months' treatment.

The above will only apply to patients who have had no further relapse. For those who have relapse, treatment must be extended very much longer.

Thus it will be seen that syphilis is treated in the Army not only with the view of relieving its present manifestations, but of also preventing further trouble and bringing about a cure of the disease itself. There is no compulsion as to the actual method which is to be employed, but there is as regards continuous treatment; and as medical officers have long since discovered that the only possible practical way of carrying this out is by intra-muscular medication, they have universally adopted it in preference to all others.

In comparing these three methods of administering mercury, it must suffice here to do so from the point of view of convenience, rather than from that of therapeutics. For even granted that they are all three equal as regards the latter, what we have to see is, which of them is the most convenient method, both for the patient and surgeon, and which of them will enable us best to carry out that prolonged treatment which we know to be absolutely necessary to procure prevention and cure. To take the ingestion method first, what are its supposed advantages as regards convenience? It is claimed for it that it is practical, that it is easy and convenient, as well as certain in its merits. In fact, what is more simple than to swallow every day one or two pills, or one or two spoonfuls of any kind of mercurial preparation? As regards its being "practical," on the ground that it is easy and convenient, this may possibly be true as compared with treatment by inunction; but it is certainly not when brought side by side with the intra-muscular method, which calls for only one injection a week. It is decidedly not nearly so "certain" a line of treatment as either inunction or injection, for the amount of mercury which is absorbed into the system is uncertain, owing to the irregularity with which patients take their powder, pills, or medicine. This among the lower classes is the result of deliberate neglect, whilst in the upper and educated classes it is nearly always the

result of forgetfulness. As regards "simplicity," ingestion compares favourably in this respect with inunction, but certainly not with injection of the insoluble salts of mercury, when, instead of having to take pills, powder, or mixture four times a day over extended periods, all that is needed is that the patient pay a visit to his doctor on one day a week or fortnight, and is not detained for longer than a few minutes.

As regards the advantages of the inunction mode of treatment, I think that as anything like a routine measure it cannot be recommended.

The advantages of the intra-muscular method are: (1) Treatment is in the hands of the medical man, who is thus certain as to whether the patient gets treated or not; (2) definite dosage with almost certain absorption; (3) treatment calls upon the patient's time for only a few minutes once a week; (4) cleanliness and professional secrecy; (5) non-interference with the digestive system, which it sets free to do other work.

The disadvantages are: (1) Pain, nodosities, and abscesses occurring at site of injection; (2) mercurial stasis. As regards pain: with improved technique it has practically disappeared. As a rule there is absolutely none, and, if present, is of such an infinitesimal nature as not to be worth notice. The same may be said as regard nodosities and abscesses, to say nothing of the much-vaunted emboli. To my mind, the only legitimate objection that can be raised against the intra-muscular method is that, once the injection is given, there the mercury must remain until absorption takes place, so that should stomatitis intervene the cause of it cannot well be removed. This has been reported to have resulted in grave salivation, a state of affairs it has never been my lot to see. Otherwise, I cannot conceive one argument in favour of the ingestion or inunction methods of treatment over the intra-muscular. On the contrary, as a convenient plan, everything favours the latter, and personally, if I had to choose between these three methods as to which I should select to be treated by, I should not hesitate to plump for the intra-muscular. I should say to myself, if I select the internal I shall be obliged to swallow medicine in some form or other two, three, or four times a day for months, and to be reminded each time of the skeleton in my cupboard, and am certain sooner or later to suffer from diarrhœa, gastritis, or enteritis, when treatment will have to cease, and I will be left in a worse plight than before. Or should I select inunction, I shall have to undergo a rubbing each day, which will take me, all told, the best part of an hour; whereas if I choose the intra-muscular, all the trouble or inconvenience I am put to is a visit of a few minutes once a week or once a fortnight to my doctor. I may possibly feel a small amount of pain or stiffness after each visit, but I need not think any more of treatment until the next attendance. To my mind, we have in the intra-muscular method a plan of treating syphilis which places us in a position not only to ameliorate present symptoms, but also to prevent future ravages, and

eventually effect a cure of the disease. Why is it, then, that this which has proved such a boon on the Continent of Europe and in the British Army has not been universally adopted in England? I cannot help thinking that one of the chief reasons for this is conservatism on the part of the profession, or, in other words, its rooted dislike to anything new. Although born in England, antiseptic surgery took longer to spread there than in any other country; in the same way, although the intra-muscular method was first introduced by an Englishman—Berkeley Hill—in a paper which was published in the *Lancet* in 1854, it went unnoticed and was ignored by his countrymen.

In a French work before me there is an epitome of the various medical opinions which were held in different countries in the year 1882-83 as regards this method, of which most authorities even then spoke enthusiastically as to its therapeutic effects. I find the following as regards England: "En Belgique et en Angleterre, on ne se préoccupe pas beaucoup de cette méthode." And thus it is to-day, with the result that the treatment of syphilis in England is one of symptomatic amelioration rather than any real attempt at prevention or cure.

The success which has followed the plan of treating syphilis in the Army is an object-lesson, and until some such method is adopted generally throughout England, things are likely to remain as they are, and syphilis will be inefficiently treated.

THE ROYAL ARMY MEDICAL CORPS.[1]

By Colonel DAVID BRUCE, C.B., F.R.S.
Royal Army Medical Corps.

The Editor of *Alma Mater* has asked me to write a short article on the Royal Army Medical Corps, giving information which may assist medical students who are trying to choose a career.

It may be as well to commence by stating the financial view of this problem, and give the rates of pay in the Army Medical Service.

(1) Rates of Pay, Allowances, &c., for Medical Officers.

Pay and Allowances.

Lieutenant	£326	0	0	Per annum.
Captain (*i.e.*, after 3½ years' service)	372	0	0	
Captain (after 3½ years as such)	400	0	0	
Captain (after 10 years' total service)	472	0	0	
Major (after 12 years' total service)	583	0	0	
Major (after 15 years' total service)	629	0	0	
Lieutenant-Colonel (after 18 to 20 years' total service)	711	0	0	
Lieutenant-Colonel (after 3 years as such)	802	0	0	
Colonel	1,008	0	0	
Surgeon-General	1,500	0	0	
Director-General	2,000	0	0	

[1] Reprinted from *Alma Mater* (Aberdeen University Magazine) of November 27th, 1907.

It will be seen from this list that a medical graduate, aged 21, can at once step into an income amply sufficient for his wants from the day of his joining the Service. In few other branches of the medical profession is this possible. Again, when the medical officer has reached a suitable age for marriage, say 28 to 30, he finds himself within reasonable distance of his majority, with an income of nearly £600 a year.

What percentage of civil practitioners can equal this? It is true 15 to 20 per cent of the medical men in civil life may do better, but the remaining 80 to 85 per cent. must be content to struggle on all their lives on £400 a year or less.

It may then be said that a medical officer enjoys a larger income than the large majority of civil practitioners, and he earns it more pleasantly.

Charge Pay.

When an officer is in charge of a general or other hospital, or of a division of a general hospital, he receives in addition charge pay at the following rates. If the number of beds equipped amounts to:—

50 beds	.. .. ..	£45	12	6	Per annum.
100 ,,	.. .. ..	91	5	0	
200 ,,	.. .. ..	136	17	6	
300 ,,	.. .. ..	182	10	0	

And there are other conditions under which an officer of the Corps receives extra pay; for example, when he is appointed as clinical pathologist, sanitary officer, or to many other posts in which special knowledge is required.

Gratuities.

It is also a further inducement to join the Service the fact that, should he not care for military life, the medical officer has the option of leaving after three years, and joining the Reserve, with an annual honorarium of £25, or after eight and a half years' service with a gratuity of £1,000. He is then at a suitable age to practise, and this money will assist him in setting up in civil life.

Pensions.

Again, if he elects to remain in the Service he becomes entitled, after twenty years' service, when still comparatively young, to a pension of £365 a year, with substantial increases on further service, up to £730, the pension of a Surgeon-General, or £1,125, the pension of a Director-General.

Pensions are also granted to the widows and children of officers.

(2) Comparison of the British and Indian Medical Services.

This is rather a delicate subject to handle, but as the question of the comparative merits of the British and Indian Medical Services is being continually asked, I will touch on it with as little prejudice as possible.

In my opinion, the conditions of service in the Royal Army Medical Corps compare, nowadays, very favourably with the Indian Service.

In the latter Service an officer has to spend the whole of his life in India, whether the climate suits him or not; whereas, in the British Service, medical officers spend, broadly, half their service at home; and if any climate does not suit, it is easy to get transferred to other and healthier countries.

Again, one of the strongest arguments in favour of the Indian Service was the opportunity of making large incomes in private practice. This was undoubtedly true in former days, but now these opportunities have become much limited on account of the large number of medical subordinates who have taken on the *rôle* of civil practitioners.

Lastly, the emoluments which the Indian medical officer draws, are largely discounted by the expenses which he necessarily incurs, if married, in the payment of passages of wife and family to and from India, in sending his family to the hills, and in keeping his children at home for educational purposes.

(3) Further Remarks on the Conditions of Service in the Royal Army Medical Corps.

Broadly speaking, medical officers of the British Service spend, alternately, four years at home and three to five on foreign stations. There are, of course, numerous exceptions to this rule, as officers often exchange with their fellows in order to stay at stations which they affect. The life, therefore, is a pleasant one, spent in widely different parts of the world, with a fair proportion of service at home.

The duties are interesting, and nowadays a man can push himself to the front and gain increase of pay and accelerated promotion by special devotion to almost any branch of medicine, including one so apparently non-military as gynæcology. Then, again, he has sixty-one days' leave every year, and opportunities for sport, travel and recreation of all kinds, such as the civil practitioner can seldom indulge in. There is, moreover, abundant leisure, and unequalled opportunities of pursuing scientific work.

The Royal Army Medical Corps now possesses a College in London which affords teaching facilities second to none in the United Kingdom, and also a Mess which has all the features of a good London club.

It will be seen, then, that the Service opens up a career for various types of men; from the man of action to the student of science.

(4) The Service as a Scientific Career.

The writer's tastes have led him in the direction of investigation work, and his ambition is to see the Army Medical Service develop into a truly scientific corps, by which, in addition to purely Army problems, an increasing part of the scientific medical work of the Empire will be done. Just as the Royal Engineers supply men to do much of the scientific engineering work of the British Empire, so it is hoped the Medical Corps will continue to supply, in increasing numbers, men for the investigation

of medical problems, such as plague, malaria, enteric fever, Malta fever, dysentery, sleeping sickness, and other diseases, which especially tend to attack armies and hinder the development of our protectorates and colonies.

Much has been done during the past few years in this direction—sanitary appointments have been made, and laboratories for the prosecution of scientific research have been instituted at military stations all over the world. Officers holding these appointments have the opportunity of devoting themselves entirely to the investigation of the causes and prevention of disease.

That these efforts have not been wholly in vain, witness the work done on kala-azar, sleeping sickness, Malta fever, &c., by medical officers of the Corps during the last few years.

But at this point it may be argued that if a medical student has a leaning towards research work, he would make much better use of his time by joining some laboratory or institute given over to such work. The objection to this is that, unless the medical student is possessed of private means, there is little chance of his earning more than a bare livelihood in this branch of his profession. It therefore comes about that most students who start on a scientific career are driven, after a few years, into teaching or practice.

In the Service, on the other hand, a medical officer's income, though never large, is constantly growing, and at the same time his status or rank in the Army is increasing, and he need have no fear for the future, as he has his pension to look forward to. Moreover, the medical officer's life is less monotonous as a rule than the layman's; at one time he is working at nagana in Zululand, at another at sleeping sickness in Uganda, or typhoid in India.

Taking everything into consideration, therefore, it may be asserted that the Service holds out very fair inducements to medical students who have a leaning towards the scientific side of medicine.

My own dream is to see a special or intelligence branch of the Corps told off for this work. By an intelligence branch is meant a part of the Medical Corps marked off for special research work, especially in relation to the investigation of the causes of diseases which affect soldiers, and especially in order to lead to their prevention. This branch would be divided into two or more divisions, each presided over by an expert in the particular branch. Such divisions might be, to begin with, Army Hygiene and Army Pathology. The former would superintend the investigation of questions relating to water supply, sanitation, food, clothing, exercise, training, camps, &c., with a view to the lessening of the incidence of disease; the latter the investigation of such diseases as typhoid, dysentery, &c. If any officer showed signs of any genius for original work, he would be placed in this intelligence branch and under the orders of the head of one or other division.

Although such a branch is not officially in existence it is now practically so, and any medical student with scientific aspirations may be sure of a warm welcome into the ranks of the Royal Army Medical Corps, and of every opportunity being given him to distinguish himself in the advancement of knowledge and in the service of his country.

Reviews.

THE REDUCTION OF CANCER. By the Hon. Rollo Russell. London: Longmans, Green, and Co. Pp. 62. 1s. 6d. net.

The author attributes the high rate of cancer prevailing in various countries, and many other afflictions, to the large consumption of flesh, tea, coffee, alcohol, and tobacco, which he regards for the most part as toxic.

From tables deduced from the Registrar-General's Returns (1905), in a long list of countries, he finds that "All the small consumers of flesh, tea, coffee, beer, and tobacco, have small cancer-rates, all the large consumers have high rates." Similar theories have been advanced by various observers from time to time, but the distribution of cancer in animals refutes the theory that any one of the articles can be regarded as a primary cause, and the author himself emphatically states that "cancer does attack some of the most temperate and frugal."

The perverted nutritional theory of cancer is, however, an old one, and finds expression at the present day in the theory of impaired function of the digestive organs with deficiency of their secretions and ferments which normally help to keep the tissue cells of the body in control, and this defect is associated with developmental imperfections or ageing of the organs in the individual, rather than with the food factor. But special diets towards the prevention and treatment of cancer are well known and constructed so as to reduce nitrogenous food to a minimum, while tea and coffee are known to inhibit the digestive processes. In this direction, interest cannot solely be attached to articles which overtax or inhibit, but to those which may assist or stimulate. For instance, the author includes in his indictment cheese and sugary things, especially after middle age, whereas Metschnikoff considers the lactic acid microbes, which may be deficient at such periods and which flourish on sugar, of importance in tending to combat the general wear and tear of the body or the invasion of other parasites.

With the qualifications necessary to be borne in mind, as the author himself states (*e.g.*, errors of classification in different countries, age, &c.), the tables he gives are striking, and serve to direct renewed attention not only to the nutritional aspect of the problem, but to the advantages of plain living. T. L.

STUDIES IN LABORATORY WORK. By C. W. Daniels and A. T. Stanton. London: John Bale, Sons and Danielsson, Ltd. 16s. net.

This is the second edition of the work which has been enlarged and brought thoroughly up to date. The book is primarily intended as a guide

to pathological research work in the Tropics, and there are many useful hints given as to fitting up a make-shift laboratory, as well as with regard to the many modifications of ordinary investigation procedure necessitated by the conditions which exist in Africa and the East.

We specially note an admirable article on Fleas, a family too often neglected or omitted in works on parasitology, but of vast and increasing importance.

With regard to the title of this work, confusion may arise from the fact that, while the title-page is marked "Studies in Laboratory Work," the name on the cover reads, "Laboratory Studies in Tropical Medicine."

A. I. F.

AIDS TO PATHOLOGY. By Harry Campbell, M.D.Lond. London: Baillière, Tindall and Cox. 3s. 6d. net.

This is an admirable little cram-book, a *multum in parvo* in every sense. It fills a long-felt want, for up till now there has been no work on Pathology comparable to that *vade mecum vital*, the "Pocket Gray." The overworked medical student has no time nowadays to wade through the huge text-books which abound in every branch of science; he requires his information in tabloid form, as presented by the Students' Aid Series, of which Dr. Campbell's book is an admirable example. The chapter on Immunity is particularly clear and concise and might be read with advantage by medical graduates of some standing who desire to bring their ideas on preventive medicine thoroughly up to date.

A. I. F.

THE ESSENTIALS OF CYTOLOGY. By Charles Edward Walker, Assistant Director of the Cancer Research, Liverpool. London: Archibald Constable and Co., 1907. Price 7s. 6d.

This book of 130 pages forms an introduction to the study of living matter, and describes very fully the structure and parts of the cell, cell-division, fertilisation, and a last chapter devoted to cytological methods.

Cytology is a very special subject, and probably few of our officers are interested in it, but to those who are, we would heartily recommend this book as giving the latest word on this fascinating subject.

ARCHIVES OF THE PUBLIC HEALTH LABORATORY. Public Health Series, No. 1. Edited by A. Sheridan Delépine, M.Sc., M.B., &c.

CATALOGUE OF THE PATHOLOGICAL MUSEUM OF THE MANCHESTER UNIVERSITY. By J. Lorrain Smith, M.A., M.Sc., &c.

COURSE OF INSTRUCTION IN OPERATIVE SURGERY. By William Thorburn, B.S., F.R.C.S.

A HANDBOOK OF LEGAL MEDICINE. By William Sellers, M.D.

HANDBOOK OF SURGICAL ANATOMY. By G. A. Wright, B.A., M.B., F.R.C.S., and C. H. Preston, M.D., B.S., F.R.C.S., &c.

TEXT-BOOK ON DISEASES OF THE HEART. By Graham Steell, M.D., F.R.C.P.

PRACTICAL PRESCRIBING AND DISPENSING. By William Kirkby.

We have received the above-named publications of the University of Manchester, which have been placed in the Library of the Royal Army Medical College, Millbank, S.W.

Current Literature.

Observations on Fehling's Test for Dextrose in Urine.—It must have happened to everyone engaged in testing urine with Fehling's solution that indefinite reactions, difficult to interpret, are sometimes noted. The following abstracts from papers by Hugh MacLean, published in the *Biochemical Journal*, vol. i., No. 2, p. 111, and vol. ii., No. 4, p. 172, explain these anomalous results.

Normal urine requires a very much greater amount of dextrose to give a reaction with Fehling's test than is necessary to produce a distinct reaction in aqueous solution. The chief factor concerned in this is kreatinin, and not ammonia as suggested by Pavy. Increased amounts of sugar may be masked, within certain limits, by a corresponding increase in kreatinin, such as may be caused by a change of diet. The amount of uric acid present in normal urine is more than sufficient to react with Fehling's reagent in the absence of kreatinin. Kreatinin has a very powerful influence in preventing uric acid from giving a reaction with Fehling's test. It is probable that uric acid is never present in large enough quantity to give a precipitate of cuprous hydrate or oxide in a urine containing even the minimum normal amount of kreatinin. Kreatinin in the amount in which it is generally present in urine would not be likely to cause confusion in virtue of its direct reducing power. Many greenish liquids obtained on heating urine with Fehling's solution are due to the influence of sugar. The opalescent greenish milky fluid obtained in certain urines some time after boiling with Fehling's solution depends essentially on the kreatinin present modifying the reaction of some other reducing substance: as a rule this reducing substance is really dextrose present in the urine in an amount greater than the average for normal urine. Kreatin acts in the same way as kreatinin, though to a less degree.

When normal urine is boiled with Fehling's solution, the uric acid and sugar present almost immediately reduce their equivalent amounts of the solution. No effect is perceived, since the reduced suboxide is held in solution by the kreatinin. After boiling for a short time the full reducing effect of both uric acid and sugar is completed. On continued boiling the kreatinin gradually causes reduction and becomes diminished in quantity. Ultimately a point is reached when the suboxide reduced by the sugar and uric acid, added to that reduced by the kreatinin itself, is no longer capable of being held in solution by the kreatinin remaining, and precipitation occurs.

C. Birt.

The Regulations for Austro-Hungary and other Foreign Countries concerning Fitness for Service, with Reference to Defects of Vision. *Der Militärarzt* of April 12th, 1907, has an article on this subject by Dr. Siegried Beykovsky. He states that practically all the States have introduced new regulations regarding vision within the last two years, with the exception of Spain, whose regulations are thirteen years old.

Austria.—In Austria new regulations were introduced at the beginning of the present year (1907). They abolish the special lower qualifications for the auxiliary reserve and introduce instead a new classification of "inferior

fitness" for those who, on account of permanent visual defects, are less capable soldiers than others, but who, nevertheless, are suitable for general military service. For fitness to serve with the colours, *i.e.*, as combatants, the visual acuteness is increased to $\frac{6}{24}$ in one eye and $\frac{6}{60}$ in the other. Formerly it was $\frac{6}{36}$ in the best eye. Previously myopia of 4 D. for ordinary soldiers, and 5 D. for one-year volunteers, was the limit for combatants, anything over 6·6 D. rejecting for all classes of service. In the new regulations 5 D. for ordinary soldiers and 6 D. for one-year volunteers are the limits. Formerly any diminution of visual acuteness was determined by correction for myopia only. Now it is to be considered in connection with defects of vision generally; and astigmatism, which was not considered at all in the old regulations, may be corrected, but by spherical glasses only. Cylindrical glasses are not yet allowed. The railway and telegraph troops must pass the test for colour vision. In other respects the Austrian regulations remain the same as before, except that the visual acuteness in cases of squint is to meet the same requirements as in ordinary cases. Formerly a higher degree of acuteness was required in cases of squint.

Germany.—For complete fitness for service $\frac{1}{2}$ visual acuteness in the best eye is required without reference to defect in the other eye. In rifle and infantry corps the right eye must be the best. For the territorial army $\frac{1}{4}$ visual acuteness is the limit for the best eye. If the other eye is blind the acuteness is raised to $\frac{1}{2}$. Visual acuteness (*seh-schärfe*) in the German regulations means power of vision corrected with glasses, while visual power (*seh-leistung*) means power of vision without glasses. In Germany, myopia of 6·5 D. is allowed, so long as the visual acuteness is better than $\frac{1}{2}$ in the best eye.

France.—For service with the colours visual acuteness of $\frac{1}{2}$ in one or $\frac{1}{20}$ in the other eye, after correction with spherical glasses, is required; for auxiliary services $\frac{1}{4}$ in one and $\frac{1}{20}$ in the other eye are allowed. With this visual acuteness myopia of 7 D. for combatant and more than 7 D. for auxiliary services, does not exempt from service. Hypermetropia and astigmatism, corrected with convex glasses, are compatible with combatant service, and nystagmus and strabismus with auxiliary services.

Italy.—Visual acuteness corrected with glasses up to $\frac{1}{3}$ in one eye and $\frac{1}{12}$ in the other, with 7 D. myopia, is the limit for combatant services. The same visual acuteness must be reached after correction for hypermetropia or astigmatism.

Russia.—Visual acuteness less than $\frac{1}{2}$ in either eye rejects for military combatant service; but if one eye is better than or equal to $\frac{1}{2}$, the other may be as bad as $\frac{1}{20}$. If the right eye is the best, the man must enter a line regiment; if the left, he is employed in other branches of the service. The visual acuteness is determined without glasses, and both on and off duty the rank and file are not permitted to wear glasses. One-year volunteers are exempt from this rule, and myopia and hypermetropia up to 4·5 D. are allowed. Astigmatism up to 3 D. in both meridians, or of 4·5 D. in one meridian only, is also allowed in the case of one-year volunteers.

Sweden and Norway.—Visual acuteness of $\frac{6}{10}$ in one and $\frac{1}{10}$ in the other eye is the limit, but if one eye has at least $\frac{8}{10}$ visual acuteness, a lower degree is permitted in the other. For service in the field $\frac{6}{10}$ in one

and $\frac{1}{10}$ in the other, or binocular vision of $\frac{3}{10}$, is required. Myopia of 4 to 6 D. is permitted. A high degree of squint debars only from combatant duties. For officers the regulations are more stringent. As a rule they are required to have normal visual acuteness in one and at least $\frac{8}{10}$ in the other eye; only in special cases is $\frac{6}{10}$ allowed. Cavalry, field and coast artillery officers and also naval officers are prohibited from wearing correcting lenses. Others may wear lenses up to 4 D. and 5 D.

Spain.—The regulations are very complicated, and the means of determining rejection for visual defects elaborate. The system is old-fashioned and depends on correction with certain numbered glasses for near and distant vision. The value of these glasses is not scientifically expressed, but myopia of 6 D. passes.

England.—The author states that the English standard of fitness is determined by visual power only (*seh-leistung*) and not by visual acuteness (*seh-schärfe*). In this he is perfectly correct. The standard is $\frac{1}{2}$ normal vision with both eyes, or normal vision with one eye and at least $\frac{1}{4}$ with the other. Russia is the only other country that determines vision without correcting lenses.

The author concludes his article by discussing the question of allowing soldiers the use of correcting lenses or not, and whether it is wise to employ soldiers in the fighting line whose myopia is 5 D., and whose glasses may become useless on account of dirt, wet, &c. He points out, however, that in this respect the Austrian standard (5 D.) is better than the Spanish (6 D.), German, Swedish and Norwegian (6·5 D.), or French and Italian (7 D.) standards.

W. G. M.

Opsonins.—Dean (*Proc. Roy. Soc.*, vol. B. 76, p. 506) shows that the opsonins for cocci in immune sera are thermostable when tested by the Wright-Douglas method, and that opsonins for cocci can still be demonstrated in heated normal sera if one soaks the cocci in an excess of the heated serum. The effect of heating an immune serum was to reduce its opsonic value to about one-half in the first two minutes; after that there was no further loss. By saturating cocci with normal serum and subsequently passing them through immune serum, he showed that they took up no more opsonin, from which he concluded that the opsonins of normal and immune sera are identical. He considers that the opsonic effect of heated sera is only another phase of the activities of immune-body. In a second paper (vol. B. 79, p. 399) he shows that the opsonic effect of an unheated normal serum and a heated immune serum mixed together, is much greater than the sum of each of these acting separately, also that the addition of anti-complement to an unheated serum had the same effect as heating it; he concludes that opsonin is the same substance as immune-body and that it acts very much more vigorously in the presence of complement. He finds that the number of cocci ingested is proportional to the strength of the emulsion used, but that dilution of the serum has very little effect in reducing the phagocytosis until a dilution of 1—4 or 1—8 is passed. This dilution phenomenon makes it very difficult to understand how the Wright-Douglas method can give a measure of the content of a serum in opsonins, seeing that a four-times diluted serum produces as much phagocytosis as a whole serum. Cole

and Meakins (*Johns Hopkins Bulletin*, vol. xviii., p. 223) have used the Wright-Douglas method as a control to the administration of gonococcus vaccine, and have obtained curves resembling those given by the authors of the method. They are, however, undecided about the value of the test, and think that one should not take account of any but wide variations. Jean and Sellands (*Johns Hopkins Bulletin*, vol. xviii., p. 232), working on tubercle, found that the count varied a good deal according to the part of the slide examined. Six simultaneous estimations of the opsonic index, based on fifty cell counts, in a case of tubercular peritonitis with fever, gave indices varying between 0·4 and 2·34. They consider that the variations shown in charts may be largely accounted for by the laws of chance. They failed to get reliable results for diagnostic purposes by testing for immune opsonin in heated sera as recommended by Wright. At the same time, although they consider the Wright-Douglas method of estimating opsonins to be unreliable, they got good results in the treatment of tuberculosis by tuberculin R. on Wright's lines.

Fitzgerald, Whiteman and Strangeways (*Bulletin of the Committee for the Study of Special Diseases*, vol. i., No. 8) made an exhaustive examination of the Wright-Douglas method for estimating opsonic indices in tuberculosis, their counts running into thousands of cells, and they obtained extremely irregular results. These are difficult to analyse shortly, and it is only possible to give a few examples: (1) Comparing the results from two capsules taken from the same subjects, the counts of successive series of fifty cells varied very greatly, and when compared with those obtained with the serum of a tubercular patient, the opsonic index of the latter came out anywhere between 0·52 and 1·51 in the case of one worker, and between 0·82 and 2·35 in the case of another worker. (2) Counts of fifty cells from two different capsules of blood, taken from the same subject, gave differences as high as 228 per cent. between extremes, whilst differences of between 50 per cent. and 100 per cent. were common. In counts of twenty series of fifty cells each in specimens prepared with normal and with tubercular bloods, there was no count among the normal which did not find its fellow among the tubercular, and *vice versa*. Counts of slides made in another laboratory confirmed the results obtained with the workers' own slides. These results cast a good deal of doubt on the reliability of the Wright-Douglas method so far as tuberculo-opsonic work is concerned. At the same time, it must be pointed out that the technique adopted is not above criticism. In the washing of the cells it is to be noted that an unnecessarily strong citrate solution was used to receive the blood, and the centrifuging appears to have been prolonged far beyond what is necessary: both these things have been found by the workers to damage the cells, and that this occurred in the workers' experiments is shown by the fact that 21 per cent. of the cells failed to phagocyte. The emulsion, also, appears to have been very weak: the average bacteria phagocyted being below two. It is the experience of most workers that weak emulsions give irregular results. It would have been interesting to have had some observations on the reliability of the incubator used; variations of a degree in temperature make very considerable differences in phagocytosis experiments. Whether the results of the writers are confirmed or not, it seems fairly obvious that work on phagocytosis, and especially the more difficult tuberculo-opsonic work, can only be safely

carried out by workers of considerable experience, and cannot be relegated to any man who has done a three months' course of bacteriology, as is frequently the case at present.

Moss (*Johns Hopkins Bulletin*, vol. xviii., p. 237) gives the results of some work on staphylococcus opsonins, using both diluted and undiluted sera. He finds that the opsonic index of a normal rabbit may vary as much as that of a rabbit which is inoculated, except when tested with sera diluted to 1—50 and 1—100. It is to be noted that the doses which this worker gave to his rabbits were enormous, being sometimes twelve times as much as one would give to an adult man: this suggests a somewhat rough procedure, which does not encourage respect for the results obtained.

Russell (*Johns Hopkins Bulletin*, vol. xviii., p. 252) finds by saturation experiments that normal opsonins are non-specific, whereas immune opsonins are specific. This contradicts the findings of Bullock and Western so far as normal opsonins are concerned. The methods of the workers differ, however, in one important particular: Bullock and Western centrifuged their sera after saturation, whilst Russell filtered his. The influence of the filter may explain the differences in their respective results.

H. Klien (*Johns Hopkins Bulletin*, vol. xviii., p. 245) describes a new method for estimating the opsonic index, which depends on finding the highest dilution of the serum that will give any phagocytosis. He uses a thick emulsion of a virulent organism and classes any phagocytes below 0·5 bacteria per cell as negative. Working in this way he found that opsonins for *Bacillus typhosus* are formed in considerable quantities during immunisation of rabbits with this organism, and the curve corresponds very closely to the amboceptor-curve obtained by a modification of Stern and Kortes' method. Both these curves showed a steady constant rise, whereas, when tested by the Wright-Douglas method, the same sera showed a progressive lowering of opsonic index to below normal (bacteriolysis?) He found that the opsonin for *B. typhosus* in immune sera was thermostable, whereas that of normal sera was partially thermolabile, which agrees with Dean's findings on the opsonins for cocci. He suggests the use of heated serum in a dilution of 1—30 as a diagnostic test for the presence of thermostable immune opsonins in typhoid fever. Klien's method has been tried at the Royal Army Medical College, and his main results have been quite confirmed. It is unfortunate that the labour involved in it renders the method unsuitable for clinical purposes.

W. S. Harrison.

Correspondence.

MALTA FEVER IN THE ORANGE RIVER COLONY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—I enclose a letter which I received the other day from Dr. Reich, of Senekal, Orange River Colony, as I thought it might interest your readers. His explanation of the diminution in prevalence of Mediterranean fever in the Orange River Colony, following the substitution of cows for goats on the farms, would probably hold good for other districts besides Senekal.

Dr Strachan tells me that only the poorer farmers use goats' milk. He also informed me that there had been a good deal of Mediterranean fever in Senekal district.

I am, &c.,
J. G. McNAUGHT,
Major, R.A.M.C.

Wynberg, Cape Colony,
September 29th, 1907.

To MAJOR J. G. McNAUGHT, R.A.M.C., *Cape Town.*

DEAR SIR,—In reply to your kind letter, I am sorry I cannot accede to your request for material, as I have no cases of Malta fever under my care. I had a great number of cases during the years 1903-06, but during this year (1907) I have not treated one case. I never saw a case of Malta fever before or during the war in this district.

The goat-milk theory coincides excellently with the introduction of the disease into this district, and the spreading of it. Before the war the farmers did not have goats, and did not drink goats' milk; after the war a number of goats were imported from the northern districts of Cape Colony, and goats' milk was used in the first years.

In a certain part of the district round Britsberg I counted thirty-two households where the people suffered from Malta fever. All of them used goats' milk. Two households only round Britsberg were free of Malta fever, and in these no goats' milk was used.

Now that the farmers are getting over their pecuniary difficulties cows are being introduced, and it seems that Malta fever is disappearing as a result.

Yours, &c.,
F. REICH.

Senekal,
September 22nd, 1907.

SIMPLE FORM OF TOURNIQUET: A SUGGESTION.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I was much struck while reading the official casualty returns in the late Russo-Japanese War by the very large number of soldiers who succumbed to wounds of the upper and lower extremities as the result of hæmorrhage.

On a battlefield of many miles' frontage it must be impossible for the medical officers and stretcher-bearers to treat in time all casualties of this sort; especially must this be the case during the heat of a great action, when even exposure for perhaps a few minutes means destruction; and during a retreat, when necessarily the wounded must be left unattended. In my own experience, during the South African War, I have known many men die on the field through their inability to stop a comparatively simple hæmorrhage from the brachial and femoral vessels, and the experience of medical officers on the Indian frontier seems to coincide with mine.

It seems to me, therefore, that if a simple form of tourniquet could be fixed into each soldier's field service uniform, it might be the means, not only of saving many lives on the field of battle, but also of lessening to a large extent the work of the medical officers in the field. In a large action, with twenty or thirty thousand casualties, the tourniquets must necessarily be found inadequate in numbers. As far as I can see, a simple tourniquet, consisting of a strap and buckle, could be fitted in the uniform at the shoulders and hips, without any inconvenience to the movements of the arm, without being the least unsightly, and at a very small cost (7d. a tailor informs me). The strap of the tourniquet would pass through loops in the lining of the arm and leg of the trousers respectively, and the buckle alone would appear on the outside. If shot through either extremity, all the soldier would have to do would be simply to give a pull on the free end of the strap and buckle off. A small pad in the case of the leg might be advisable; but in any case there would be no inconvenience to the soldier, and I think this arrangement might, in many cases, be the means of saving his life in action. Any soldier could be made to understand the method of using it, a mere pull at the free end of the strap making a band of constriction round the limb.

Yours, &c.,

Station Hospital,
Karachi.

RICHARD HOLE,
Captain, R.A.M.C.

[While agreeing with Captain Hole's data, we think the means he suggests for meeting the danger of hæmorrhage from main arteries in the limbs unsuitable. The straps would be very much in the way, and their efficacy for compressing the artery is very doubtful. Further, there would be great danger of gangrene from their being improperly applied, and perhaps left on too long. The remedy, in our opinion, lies in teaching every man how to find and digitally compress the chief arteries, not in adding complications to his uniform, complications that would hardly ever be of any real use.]

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Original Communications.

THE ADVISABILITY OF OPERATION FOR RECURRENCE OF HERNIA IN THE SERVICES.[1]

BY MAJOR M. P. C. HOLT, D.S.O.
Royal Army Medical Corps.

WHEN a man presents himself with inguinal hernia, recurrent after operation, opinion is not infrequently expressed that there is no advantage in retaining him in the Service; operation has failed once and will do so again; it is better to invalid him.

It is in order to combat such opinion, which is, I think, much open to question, and to provoke some discussion, that I have ventured to bring the matter to notice. The subject is important for several reasons; firstly, if a man with recurrent hernia be invalided out, the State unnecessarily loses his services; secondly, the individual himself loses any advantage he may have been hoping for, either as pension by continuing in the ranks, or as pay by joining the Reserve; thirdly, it is within my own knowledge that it may be very difficult for a man who has been invalided out of the Army for hernia (or, for that matter, with any other physical infirmity) to get employment in civil life. In such a case, after leaving the Service he may go to a civil hospital for operation, and with ordinary fortune be cured. It is suggested that, for obvious reasons, this is very undesirable; moreover, in such event he will have again become fit for the Service, which he should

[1] Paper read before the United Services Medical Society on January 9th, 1908, at the Royal Army Medical College, Millbank, S.W.

never have left. Finally, if the original hernia has been caused in and by the Service, or if the unsuccessful operation has been performed in the Service, no matter whether the patient was or was not the subject of congenital hernia; or if, having been operated upon before enlistment, the recurrence itself has been caused in and by the Service; then, in any of these circumstances, should we give medical evidence that the condition is now incurable, on the face of it the patient has a strong claim against the State for compensation, and that, too, for what had been incorrectly pronounced as incurable. This I claim to be an untenable position, for there is abundant evidence that recurrence of hernia offers a distinct probability of cure by operation, in not less than 80 per cent. of cases.

In order to properly estimate the probability of curing recurrent hernia by operation, it is necessary in the first instance to survey the factors that tend to bring about recurrence. Of these the first and most frequent is undoubtedly sepsis; all authorities are agreed upon this point. As to the rest, one cannot do better than quote one of the best known text-books on surgery,[1] where it is stated that (*a*) injudicious selection of cases, (*b*) errors in technique, and (*c*) faulty after-treatment, are the most prominent causes of failure.

As to *sepsis*.—If the operation wound should become septic, whether due to imperfect technique at the time of operation, or to the accidental infection of the dressings during the first few days, or to uncontrolled curiosity on the part of the patient leading him to insinuate his hand under the dressings; then, if the infection invade the deeper parts, in the place of immediate union of normal tissues, there results in the inguinal area a mass of non-contractile, at first inelastic, scar tissue; when stress comes there is no valve-like closure of the canal, and by degrees the scar stretches or finally splits, and a hernial sac protrudes.

Then as to *injudicious selection of cases:* General muscular debility, anæmia, extensive fatty degeneration, persistent cough at the time of operation, especially "if present during the first few weeks after operation,"[2] and organic disease, are all familiar contra-indications for the operation for radical cure.

Errors in Technique.—Every surgeon operates on his first case; technique in his first ten cases will not be so good as in his second hundred. A type operation in the first instance, if faithfully and

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[1] Rose and Carless, sixth edition, p. 1079.

[2] Jacobson, "Operations of Surgery," Fifth Edition, vol. ii., p. 65.

deliberately carried out, is not usually a difficult matter; still, difficulties do, not uncommonly, arise. These may be sufficiently disconcerting to any young operator to divert his attention somewhat from his original set plan, and so lead to an imperfect operation.

Amongst the multiplicity of operations that have been devised for the radical cure of hernia, it is doubtful whether any are bad, though the tendency on the whole is seemingly towards improvement. Possibly some of the older cases of recurrence that come to notice, such, for instance, as those who were operated on in childhood, perhaps twenty or more years ago, were done according to methods not quite so constantly successful as the more recent procedures; still, remember the remark of Tillmann,[1] that "it is not so much the method as it is the good technique of the operator which is the main factor in avoiding a recurrence." Amongst the errors in technique must be considered the attempt to confine within the abdomen large masses of omentum, or extensive coils of intestine in old-standing hernia, the re-introduction of which necessarily raises the intra-abdominal tension considerably. The omentum, without question, has important functions, some of which are only now being elucidated, but if it is excessive in amount, especially in conjunction with proptosis of the transverse colon, and perhaps of the stomach, these considerations of function must be partly subordinated to the necessity, often so obvious, of considerable reduction of abdominal contents; neglect of these considerations may make for recurrence. In case of absolute necessity, too, I should not hesitate to perform enterectomy, which operation can be done with scarcely any additional risk, and we know that the human economy does not suffer any ill effects from the loss of a considerable number of feet of small intestine.

Bloodgood[2] notes two other causes of recurrence, "the obliteration of the conjoined tendon, a cause of recurrence in the lower angle of the wound; and the presence of the transplanted cord in the upper angle of the wound in cases in which the cord was transplanted *in toto* without excision of veins." In operating on four cases for recurrence, "the small sac was situated above, and accompanied a large bundle of veins through the abdominal wall." He reports, in addition to cases of recurrence after Halstead's operation, nine cases of operation for recurrence after previous operation by others; in two there had been suppuration, in three the recurrence was in the lower angle of the wound, associated with

[1] "Surgery," p. 200.

[2] *Johns Hopkins Hospital Reports*, No. 7, 1899, p. 223.

obliteration of the conjoined tendon, in one two operations had already been done.

The attitude of surgeons towards transplantation of the cord in regard to probability of recurrence varies; by some it has been claimed that a larger percentage of recurrences followed when the cord had been transplanted than otherwise, but this Coley[1] denies, saying, "a comparison of the results of the two methods at the Hospital for Ruptured and Crippled, shows slightly increased percentage when the cord has not been transplanted."

Park[2] mentions giving way of stitches, use of drainage, sepsis, advanced age, large size of hernia, relaxation of scar, and fatty abdominal walls, as responsible for recurrence; he says that scar tissue under persistent pressure stretches, gives way, and so accounts for a large percentage of ventral herniæ. As to giving way of stitches, v. Bergmann[3] says catgut is absorbed too rapidly, but he makes allowance for variation of opinion on this point.

It is well to be assured that an operation for radical cure has actually been done, and not merely a herniotomy for relief of strangulation with no attempt at radical cure. Nowadays it is usual to proceed to radical cure after relief of strangulation; formerly this was not so frequently done; and in old-standing cases of apparent recurrence one may be misled by the patient, in perfect good faith on his part; conditions may have absolutely barred any attempt at radical cure, but these the patient may fail to be aware of or remember.

Faulty after-treatment falls under two headings, viz.: (*a*) On the part of the surgeon; (*b*) indiscretion on the part of the patient. As regards (*a*) may be mentioned too early getting out of bed; the tendency latterly has been to greatly shorten the period that formerly was considered necessary. Kocher[4] allows only eight days in bed, but a minimum of fourteen days is advised by many surgeons, to be followed by not less than six weeks' abstention from hard work or very active exercise. There is a general consensus of opinion that a truss should not be worn after operation, as it necessarily causes some atrophy of the parts under pressure, and must interfere considerably with the exercise of the normal function of the musculature about the canal. (*b*) As instances of indiscretion on the part of the patient, I may mention two. I operated upon a man in Pretoria who was in one of the Colonial

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1 "Progressive Medicine," vol. ii., 1906, p. 20.
2 "Surgery," p. 949. 3 "Surgery," vol. iv., p. 517.
4 "Operative Surgery," Second English Edition, p. 243.

Corps. Whilst he was still in hospital the period of his engagement terminated. He then took a small hotel, and within a week or two of leaving hospital attempted to lift a heavy wardrobe by the plinth, and whilst in a squatting position felt something give way. He had a distinct hernia at the upper end of the scar. Another patient, not my own, took it upon himself to ride; feeling no inconvenience, he put his horse at a jump; the horse "pecked," and as a result he had a distinct though small recurrence.

I have heard an objection raised to Kocher's sac transplantation method, on the grounds that recurrence has been met with through the abdominal muscles where the sac is passed through them. In reality such would not be "recurrence"; it would be a ventral hernia, but it does not happen if the method is properly carried out. I have used this method now for five years, and have not seen any sign of such a result. Sepsis in the wound does not necessarily mean recurrence. I have examined a number of men where it was quite obvious that sepsis had taken place, but with no sign of recurrence present. Two such have come to me for operation for the cure of inguinal hernia on the other side, which had not existed when the first side was operated upon. Still this can in no wise be any excuse for halfheartedness in the strict observance of the postulates of aseptic surgery.

Bryant[1] gives some interesting figures in this connection with regard to Halstead's new operation. Of 195 operations, recurrence took place in 5·6 per cent. in from six months to nine years; and of these, in instances of primary union 3·3 per cent. recurrences, of secondary union 25 per cent. recurrences.

Cases of late recurrence, say after three years, can scarcely be attributed to faulty after-treatment. Bloodgood mentions one where, three years after the first operation, recurrence was brought about by heavy lifting; so also quite exceptional strain or accident; thus severe accidental injury to the groin nine weeks after operation. One such case that came to me is interesting. Thirteen years after the first operation, during a night attack, whilst carrying a rifle and ammunition, he fell, and his body formed a bridge between two large boulders on a kopje, and so accounted for a rupture.

Generally recurrence is gradual, and rarely precipitate, but much depends upon the cause—whether bringing about a gradual stretching of the scar, or whether sufficiently severe to bring about a sudden rent in the scar tissue. If the peritoneum be closely

[1] "Operative Surgery," vol. ii., p. 921.

adherent to the scar at the point of splitting, it also may be ruptured, and there may be no peritoneal sac.

Very extensive statistics have been published in literature as to the incidence of recurrence, but here I will only mention that v. Bergmann[1] gives figures from the clinics of five Continental surgeons which give a mean percentage of 2·6 recurrences. Jabot supposed that no sane man claims no recurrences, excepting perhaps the man who had done one case only and that successful. There seems to be good reason for supposing that direct is more liable to recurrence after operation than indirect inguinal hernia, there being usually more deficiency of the anterior abdominal wall. Many recurrences appear nearer the middle line than the site of the pillars of the external ring; such are not unlike direct inguinal hernia, but are in reality ventral herniæ. However, the experience of surgeons who have operated on many cases of recurrent hernia, varies widely as to the actual site of the recurrence. It is not a very important point unless in a very large number of cases positive evidence be obtained as to the actual method followed out at the primary operation.

As to the date of recurrence, with reference to the time that elapsed since the primary operation, statistics vary somewhat, but generally

65 per cent. appear within six months,[2]
80 per cent. appear within one year,
13·6 per cent. appear in from one to two years,
6·6 per cent. appear over two years,

so that if the cure remains good for twelve months, recurrence becomes very improbable.

Which cases of recurrent hernia are not suitable for operation? The conditions already mentioned that contraindicate operation in the first instance, still more forcibly apply to operation for recurrence, but in addition to these there are some that only arise in recurrence; generally, "a second operation should be performed if the condition of the abdominal parietes warrants it."[3]

Hernia, whether primary or recurrent, implies not merely a bulging of the muscles on coughing, &c., but a definite sac, no matter how small, into which contents enter and remain when the stress is over. This distinction is Kocher's, and is a very real one; but, at the same time, in hernia of the bladder a sac is not necessarily present.

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[1] *Loc. cit.*, p. 517. [2] Coley, "Annals of Surgery," vol. xxxvii., p. 809.
[3] Rose and Carless, *loc. cit.*

If it is not thought inadvisable to operate for ventral hernia through the scar of a laparotomy wound, then why should it be so when the hernia, whether designated "ventral," "recurrent inguinal or femoral," follows an unsuccessful operation for the radical cure of one of these conditions? The substitution of the musculature of the inguinal region by a large area of scar tissue may sometimes offer very little prospect of a successful result; but it is by no means always easy to estimate the condition of the muscles before a dissection has actually been made, and it may be that on the operation table a condition is revealed which promises very badly for success, but, on the other hand, the prospect may then appear much better than had been hoped for. But when the primary operation has been effectual for a number of years, and recurrence is of recent date and apparently associated with precocious senile change, then operation will probably be futile. Only once have I refused to operate for recurrence, and that was in a middle-aged N.C.O. of unduly lax, almost flabby, habit of body, strongly suggestive of early senility, with an enormous gap in the inguinal region on both sides; there was no evidence of any constitutional disease, but the prospect of a successful result was nearly *nil*. Otherwise it does not seem to matter what length of time has elapsed between the first operation and the recurrence; an equally good result may be obtained whether the interval be three months or fifteen years; or, on the other hand, whether the recurrence itself has been present only a few weeks or any reasonable number of years. Irreducibility due to adhesions about the neck and in the sac should offer an additional incentive to operation; though enormously increasing the difficulties (and possibly on rare occasions these difficulties may eventually prove to be insurmountable), still an effort should be made to remove an extremely dangerous condition.

Technique of Operation for Recurrence.—First it is as well to remove the cutaneous scar of the previous operation by including it in an elliptic incision, not for æsthetic reasons, but because it is better that there should be only one scar, that of the last operation; it will bear evidence of primary union or of suppuration, a useful point, should there be by any mishap a second recurrence. In the deeper parts all scar tissue must be scrupulously dissected away, leaving only normal muscular aponeurotic or fascial tissue, with which only can a successful repair be confidently anticipated. This is a tedious process, requiring much care and patience; anatomical bearings are no longer normal, and the whole area is one meaningless mass of dense fibrous tissue, which bleeds readily

and persistently. The best plan is to start wide of the scar and definitely display certain structures. Commencing with the vas deferens, this, if what is still generally known as Halstead's operation has been performed, will be hidden in scar close under the skin, with which it may be almost inseparably blended; it is for this reason easy to inadvertently divide it when removing the old skin scar. It is found with certainty beyond the scar area below the spine of the pubis, and it should be pulled up from the scrotum; it must then be deliberately followed upwards and dissected out right through the scar beyond the internal ring into the pelvis, remembering that it has been intentionally displaced from its normal anatomical situation; any early attempt to find it in the first instance within the scar area will probably lead to its division. Then normal fibres of the external oblique aponeurosis well above the scar, should be defined and carefully traced downwards to their insertion. Next, normal muscular tissue of the internal oblique and transversalis in the same manner. Finally, Poupart's ligament is to be thoroughly defined. Before removing the now nearly isolated mass of scar tissue, efforts should be made to trace from below upwards the other constituents of the cord. When all this has been done, possibly the surgeon, in his earlier cases, may well be appalled at the large gaping area within which he has to reconstitute an inguinal region that will be effective, and this can be done only by uniting normal tissues; if the dissection has been incomplete he can scarcely hope to control abdominal contents by re-uniting (re-adjusting, as one surgeon has said) scar tissue; this part of the procedure, then, must be thorough and complete. To quote Treves:[1] "There are no cases so difficult to operate upon as those in which a previous attempt at radical cure has been followed by suppuration."

When the destruction of the abdominal wall has been unusually extensive, any of the ordinary typical operations for the cure of hernia may be quite impossible. Bloodgood[2] lays great stress on the difficulties attending obliteration or congenital attenuation, as the case may be, of the conjoined tendon, and for this condition transplants the rectus muscle, suturing it to Poupart's ligament. I find that much may be done to fill up the gap by mobilising the internal oblique, by a little manipulation when necessary from behind the external oblique; it may then be brought downwards, and without tension sutured to the upper and outer half of

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[1] "Operative Surgery," Second Edition, vol. ii., p. 552. [2] *Loc. cit.*

Poupart's ligament; the transplanted rectus may then be used to fill up the remaining space, that is where the conjoined tendon is deficient. Latterly McGavin[1] has secured successful results by implanting silver filigree where the destruction or deficiency is very marked. Further, it may still be possible to sufficiently mobilise the different sections of the external oblique aponeurosis, to get a considerable degree of overlapping; or it may be necessary to very accurately lace the fibres of the aponeurosis by a series of fine kangaroo tendon stitches, in order to get a firm support to the underlying internal oblique and transplanted rectus. A few months ago I followed this plan in an instance of a large ventral hernia in the inguinal region, where a prolonged process of suppuration had followed tubercular abscess in the testes and vas deferens, extending as far as the side of the bladder; so far the result is quite satisfactory, and with care should be permanent, the patient being now a sturdy lad of 17.

I have operated upon fourteen cases of recurrence, and so far as I have been able to ascertain there has been no further recurrence; several have been examined many months, and one four years after operation, with a perfect result. Of the 14 cases of recurrence, 7 had taken place in less than one year; 3 in "about" one year; 1 in three years; 1 in thirteen years; 1 in sixteen years; and in 1 the date of recurrence had not been noted.

One only of these was a case I had operated on myself in the first instance; the hernial recurrence concerned bladder only, and there was no trace of a peritoneal sac. Two were instances of a second recurrence, one of these being of a quite unusual nature. In this the second operation had secured the inguinal region, but hernia had taken place behind Poupart's ligament down the thigh; it lay in front of the psoas-iliacus muscle, the femoral vessels and femoral ring and canal; a special procedure was necessary, and this was followed by some phlebitis in the leg, but twelve months later there was no further recurrence of the hernia.

In conclusion, I suggest that though operation for the radical cure of recurrent hernia offers many difficulties, and therefore I should not advise anyone to undertake it unless he has already a reasonable familiarity with primary operations for radical cure; still the decision as to the right course to pursue with regard to this condition is a matter that concerns every administrative and executive medical officer in the Services.

[1] *British Medical Journal*, November 16, 1907, p. 1395.

ON THE USE OF POTASSIUM NITRATE AS A FOOD PRESERVATIVE; WITH SOME METHODS OF ANALYSIS.

By Major W. W. O. Beveridge, D.S.O.
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I.

A common method for the preservation of certain foods, by means of saltpetre or nitrate of potassium, has not up to the present time been the subject of very much investigation. This is probably due to the fact that there are few, if any, recorded cases of poisoning by this chemical preservative in food, and also from a general impression that the salt is harmless, or has no marked effects on the general economy in the proportions met with. The fact that the salt is rapidly excreted through the urine, probably accounts for its apparent harmless effects in small amounts, for next to the chlorate, it is probably one of the most poisonous of the potassium salts (Hare). There is, however, no accumulated evidence as to the effects of its continued use on the animal system. In the ordinary course of civilian life there is little probability of any deleterious effects arising from its continued use, as no one is required to subsist for many consecutive days on, for instance, cooked salt beef or tinned corned beef or mutton, nor would anyone dream of doing so. Under certain military conditions, however, the circumstances are entirely different. It is well known that at the present time, under war conditions, reliance for food is chiefly placed upon tinned meat, most of which consists of what are termed corned meats. Men may perhaps be required to live on these preparations for weeks or even months at a time, consuming daily about a pound, and beyond a certain amount of carbohydrate in the form of bread or biscuit, practically nothing else.

As in some recent analyses at the Royal Army Medical College (which will be given later) amounts of potassium nitrate were found varying between 1 and 20 grains per pound in fourteen tins of canned meat examined, it will be evident that the quantity present is subject to considerable variation. Although an amount equivalent to the maximum dose laid down by the "British Pharmacopœia" may not often be present, an average of 9 grains per pound seems a considerable one to be taken daily, and even if not proved to be harmful, is decidedly of no service in the economy.

There is also another risk, apart from any possible effects from the presence of the nitrate itself, which is apt to be overlooked, and although it appears at first sight to be chimerical, it may nevertheless be a real one, under certain conditions. It is, that at times the nitrates are capable of being reduced to nitrites. Now it is known that nitrites are actively poisonous, and it is just possible that some cases of meat poisoning put down to ptomaines and the like may be due to the presence of nitrites derived from nitrates in the food, as the symptoms caused by, for instance, sodic nitrite are very similar to those produced by a nitrate, and it is believed that the action of nitrates is to be partly explained by a reduction to nitrites circulating in the blood as such (Wynter Blyth).

I have investigated many cases of supposed ptomaine poisoning attributed to the eating of tinned meats, which were presumed to have been tainted or otherwise impure, and have frequently, as undoubtedly have other observers, been entirely at a loss to account for the symptoms produced, chemical and bacteriological examinations proving equally void of conclusive results. The question then arises: Is there anything in the meat itself, not being the result of decomposition, which could produce symptoms similar to those of so-called ptomaine poisoning? It is conceivable that in the presence of large quantities of vegetable food some of the nitrates consumed may be reduced, as has been observed in certain of the herbivora, and a nitrite poisoning result.

Abelous and Jules Aloy (*Comptes Rendus Soc. Biol.*, vol. 129, 56 and 124, 1899) have shown that a soluble ferment actually exists in the animal tissues, capable of transforming nitrates into nitrites; and also later (*Compt. Rend.*, 1903, 55, 1080) that the same is true for vegetable structures.

Binz ("Elements of Therapeutics," 1877) states that "all organic substances which reduce peroxide of hydrogen, that is to say, mainly protoplasm and fibrin, convert the nitrate, even if exposed to air, into nitrite (Schönlein). The same thing occurs within the body during exercise; but since the nitrate reappears in the urine as such, we must imagine that an active exchange of nascent oxygen takes place between it and the tissues and so produces its corrosive effect. If the latter occurs at the same moment as the paralysing action of the potassium, the salt, as has so often been proved, becomes a poison."

Dr. J. S. Haldane (*Journal of Hygiene*, vol. i., No. 1) remarks "that the presence of nitrates in salted meat, when this is regularly used as a food, is probably not a matter of indifference."

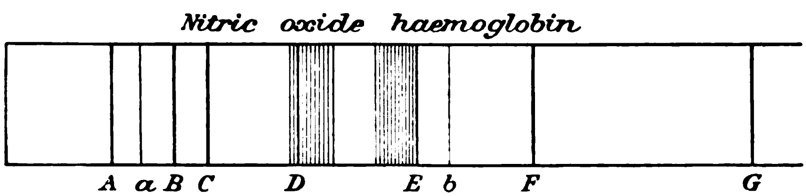
Nitrites do not occur as such in sound samples of tinned meats, as they are destroyed during the process of sterilisation: and among the large number of tins I have examined, in no case was their presence ever detected in a tin that was sound. It may be, however, that reduction of the nitrates present in these meats does take place, either without the body itself, or during decomposition of the meat by bacterial action; or possibly nitrites may be present in tins which have not been subjected to sufficient heat during sterilisation. It is well known that many of the bacteria are capable of reducing nitrates to nitrites, for instance, *Bacillus subtilis*, and many of the soil bacteria; and I have found in certain blown tins of corned beef, which on examination were proved to contain bacteria, that nitrites were present. These nitrites were evidently reduced from nitrates by bacterial action, as the analysis of sound tins of the same meat showed the presence of nitrate of potassium amounting to 1 gramme in a 2-lb. tin, but no nitrites. It is also possible that when tinned corned meat is left exposed to the air before eating, especially in close, confined rooms, where bacterial action occurs rapidly, this may prove a source of danger by bringing about this reduction process.

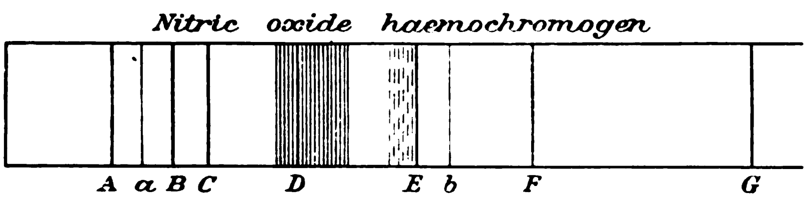
It may be taken for granted that all tinned or preserved meats which have a distinctly red colour contain nitrates; thus we have tinned corned beef or mutton, bacon, hams, salted tongues, salt meat, &c., all containing the nitrates of sodium or potassium. On a diet of such foods, if the urine be examined daily, the presence of nitrates may be demonstrated; for instance, after an ordinary breakfast of bacon, nitrates may be detected in the urine one hour after, or less, showing that their excretion is rapid.

The term "corned meat" implies that the meat has been subjected to a process of pickling in a brine containing nitre or saltpetre prior to cooking or sterilisation. The red colour, it will be observed, is more pronounced after cooking, but is diminished on exposure to air, or in advanced decomposition in presence of air.

The object of corning meat is twofold: for the supposed antiseptic effect of the brine, and to maintain a red colour in the meat; this latter presumed to be, and undoubtedly is, more attractive to the eye. The antiseptic effect of nitre in the amount used is, of course, very slight. The strength of the various pickling fluids used varies considerably, and many are kept exclusively secret. One commonly met with, called "Preservitas," contains 8·6 per cent. of nitre, combined with sodium chloride and boric acid. Another used in preserving meats contains nitre in

the form of prunella, a fused form of nitrate of potassium, beside the chloride of sodium. In certain processes the meat is kept in a pickling fluid consisting of sodium chloride, sugar, and about 1 per cent. of nitrate of potassium, in vats for nearly three weeks before being cooked, prior to sterilisation; and it appears that the average amount of saltpetre absorbed by the meat is generally over a tenth of that present in the fluid. It must be remembered that, although the exact composition of the pickling fluid is known, it bears no definite relation to the amount that will be absorbed by the meat: and different pieces of meat will take up varying quantities of the salt from the same pickle. In the case of corned meat, among fourteen tins of various makers which I have examined, the average amount of nitrate present was about 0·133 gramme per cent., or an equivalent of 9·3 grains per pound.





The red colour of corned meats is caused indirectly by the nitrate present. Dr. J. S. Haldane (*Journal of Hygiene*, vol i., No. 1, January, 1901) has shown that the red colour of cooked salted meats is due to the presence of nitric-oxide hæmochromogen; this is produced by the decomposition by heat of nitric-oxide hæmoglobin, of which the spectrum, together with that of nitric-oxide hæmochromogen, is here given. Dr. Haldane found that on extracting the pigment from freshly exposed salt meat a spectrum was given, not altered by warming the solution with ammonium sulphide, and possessing two bands at about the position of the oxyhæmoglobin bands, but not so nearly combined, being, in fact, the spectrum of NO-hæmoglobin. It is to be distinguished from

CO-hæmoglobin by the fact that on boiling NO-hæmoglobin gives a red coagulum. This NO-hæmoglobin is formed by the action of a nitrite on the hæmoglobin of the blood in the absence of oxygen, and in presence of reducing agents, and is due to a reduction within the raw meat of the nitrates derived from the pickling fluid.

I have found that the red pigment of cooked corned meats can be dissolved by the aid of gentle kneading with the fingers, in the following reagents, namely, chloroform, ether, carbon tetrachloride, methyl and amyl-alcohol; but the colour in the solution obtained is never permanent, being probably due to reduction in contact with air, in consequence of the production of methæmoglobin. In salted meat the red colour which has faded by contact with air, can be restored if the surface is covered by, for instance, glass, so as to exclude the air. The solution of this red pigment, however obtained, will give the spectrum of NO-hæmochromogen.

The medicinal dose of nitrate of potassium, as laid down in the "British Pharmacopœia," is from $\frac{1}{3}$ to $1\frac{1}{3}$ grammes, and the poisonous dose has been variably stated to be between 8 and 30 grammes. Wynter Blyth states the poisonous dose to be from 15 to 30 grammes, and that from 3 to 5 grammes produce considerable uneasiness in the stomach and bowels, with disturbed digestion and sometimes vomiting and diarrhœa, and a desire to urinate frequently.

The symptoms attributed to large doses of nitrate of potassium are nausea, great intestinal pain, vomiting and diarrhœa. Its continued use undoubtedly causes irritation and inflammation of the intestinal mucous membrane. Owing to the basic radicle potassium, it acts also as a cardiac depressant, with irregularity and slowing of the pulse. Weakness, cold sweats, aphonia, cramps and convulsions precede death. In one individual with whom I am acquainted, the eating of salted corned beef is invariably followed by distressing headache.

Ringer states "that when taken for some time in moderate doses it considerably disorders digestion, producing nausea, vomiting and a coated tongue." In large doses hæmaturia may be produced, and from its irritant effects on the renal epithelium, it must of necessity be a danger in renal complaints. Corned beef, therefore, is not an article of diet suitable for people who have a tendency to renal affections, or in those whose renal epithelium has been weakened by any of the specific fevers.

During the war in South Africa we all observed cases of what

were termed catarrhal colitis and kindred bowel irritations which were difficult to account for, and for which no specific origin could be assigned. Might not some of these have been due to a continuous irritation of the gastro-intestinal epithelium, consequent upon a prolonged use of nitrated meat?

It will be observed that many of the symptoms produced by nitrate of potassium are quite compatible with those attributed to ptomaine poisoning; but they are probably more transitory owing to the rapidity with which the nitrates are excreted from the body.

Liebreich found that in dogs a 0·5 per cent. solution caused inflammation of the gastro-intestinal epithelium, and that in artificial gastric digestion of albumin, when saltpetre was present amounting to 0·1 per cent., only three-quarters of the albumin was digested, as compared with a control. It undoubtedly, therefore, retards digestion in a healthy person.

The action of the nitrites is well known, and does not call for attention here. The collapse which they are apt to produce, however, might be mistaken for that of ptomaine poisoning.

Haldane, Makgill, and Mavrocordato (*Journal of Physiology*, vol. xxi., Nos. 2 and 3, March, 1897), from experiments on the action as poisons of nitrites and other physiologically related substances, came to the conclusion that nitrites convert hæmoglobin not simply into methæmoglobin, but into a mixture of methæmoglobin and nitric-oxide hæmoglobin; and also that their effect as a poison is due to their action on the hæmoglobin, and consequent paralysis of the oxygen-carrying power of the blood.

II.

For the presence of nitrates in food there are several recognised qualitative tests, but all have to be applied with a certain amount of caution, as we are dealing with complex mixtures. Among these tests may be mentioned ferrous sulphate and sulphuric acid; diphenylamine with either sulphuric or hydrochloric acid; or brucine and sulphuric acid. Whichever be the test applied, it is necessary in the first place to obtain the nitrates in an aqueous solution. For example, in meat, it is as well to extract the fat by means of petroleum ether and then to macerate the sample in distilled water at 80° C. for one or two hours, with constant stirring, and finally filtering. To the filtrate, which contains the nitrates in solution, the test selected can then be applied, or the colour reaction can be demonstrated on a white china tile. In using diphenylamine,

$(C_6H_5)_2NH$, it is usual to dissolve the salt in acetic acid. Some of the solution is then mixed with the aqueous solution of the nitrate in a test tube, and concentrated sulphuric acid run in, when a rich deep blue ring is formed at the junction of the two liquids if nitrates be present. A more convenient method is to prepare a 1 per cent. solution of the salt in concentrated sulphuric acid, which has the advantage of keeping better; and time is saved when using the test. Certain oxidising substances, however, also produce a blue coloration with diphenylamine, such as the nitrites, chromates, dichromates, peroxide of hydrogen, sodium, barium, &c. The nitrites give, with diphenylamine and sulphuric acid, a blue transitory ring, but the whole solution is coloured blue, rapidly fading to pale yellow; with nitrate of potassium or sodium the solution above the ring is unaffected. Chromates and dichromates give a blue transitory ring, and a deep blue to black solution. Peroxide of hydrogen gives a blue ring, identical with the nitrate reaction, but as it does not occur in foodstuffs can be disregarded. In the case of sodium chloride, a constant ingredient of foods, an error might easily be made, as it gives a blue ring and a clear solution; but even in concentrated solutions, sodium chloride gives merely a light blue ring and never the deep blue given by nitrate of potassium, which is obtained in fairly dilute solutions, such as 1 in 1,000. In using diphenylamine with concentrated hydrochloric acid, instead of sulphuric, it will be noticed that at ordinary temperatures nitrate of potassium produces no change, whereas nitrites give a blue ring and light blue solution, changing to a yellow colour, which is itself destroyed on heating. Brucine and sulphuric acid is a very sound test for nitrates in foods, sodium giving no reaction with this reagent and the nitrites only an orange colour, not the distinctive pink of this reaction. It, however, cannot be applied to detect nitrates in urine, owing to the pink coloration caused by the sulphuric acid itself.

For the quantitative estimation of the nitrates in foods, a weighed quantity, 20 to 50 grammes, is taken; if fat be present, this is first extracted with petroleum ether. The sample is then placed in distilled water (free, of course, from nitrates) for several hours at about 80° C., and finally filtered through a Buchner's filter. It is better to boil the solution to coagulate all albumins, which are then filtered off, leaving as clear a solution as possible. The residues from both filtrations are washed with distilled water, until the washings show no trace of nitrate. The combined washings and filtrate are now ready for the quantitative estimation by one of the

following methods, which are the most convenient when dealing with nitrates in organic matter :—

(1) Schloesing's method, for the estimation of nitrogen in nitrates in the presence of organic matter, is accurate, but requires considerable care and attention. Stuber's modification (*Zeit. Nahr. Genussm.*, 10, 1905) is convenient, and if carefully performed, reliable. The latter is briefly as follows: The watery extract is concentrated by evaporation to as small a bulk as convenient and transferred to a flask of as small a size as possible and boiled, to exclude all air, which is of the greatest importance. An acid solution of ferrous chloride (20 cc. of a saturated solution of ferrous chloride and 20 cc. of a 20 per cent. solution of hydrochloric acid) free from air, is run in drop by drop by means of a tapped funnel. The delivery tube of the flask is attached to a Schiffs' nitrometer, previously filled with a boiled 25 per cent. solution of sodium hydroxide. When the nitrate solution is relatively pure the acid ferrous solution should be introduced first, and the nitrate solution run in from the funnel. The contents of the flask are now boiled to dryness, pumice stone being introduced to prevent any bumping, and the gas collected in the nitrometer. The volume of nitric oxide gas obtained in the nitrometer is finally determined by the usual methods of gas analysis, and any air or other gases deducted, after standing for three hours.' It is then corrected for temperature and pressure, and calculated to nitrate of potassium. The presence of organic nitrogenous matter does not influence the results. For further particulars on the precautions to be adopted, and results obtained in Schloesing's method, a paper by Paul Piechti and Ernst Ritter (*Zeit. Anal. Chem.*, 1903, 42) should be consulted.

(2) *Gravimetric Determination by means of Nitron.*—Nitron (1 : 4 diphenyl—3 : 5 *endo* anilo—4 : 5—dihydro—1 : 2 : 4—triazole), discovered by Busch (*Zeit. Nahr. Genussm.*, 1906, 12, and abstracts, *Journal of the Chemical Society*, 1905, ii., 282, and 1906, No. DXXX. XXV., 898), is used because of the great insolubility of its nitrate. I have found that the results are accurate, and the method requires less apparatus. It is also more easily carried out than the previous determination. Fifty grammes of the substance, if meat, finely minced, are macerated in warm water for at least two hours and then brought to boiling, filtered through a Buchner, or other convenient form of filter, and washed with distilled water until the washings are free from nitrates. The combined washings and filtrate are then treated with a neutral solution of acetate of lead and three drops of ammonia solution to remove the organic matters

and sodium chloride, until no further precipitate occurs. It is then heated to boiling and filtered. The filtrate is made up to 180 cc. with distilled water, acidified with acetic acid, heated, and nitron dissolved in acetic acid added. The mixture is now cooled in ice-water for thirty hours and again filtered through a tared filter paper, the residue being washed with ice-water, dried at 110° C. and weighed. The amount found is calculated to nitrate of potassium, the molecular weight of nitron being 375, or one part of nitron nitrate being equal to 0·26973 parts of potassium nitrate. It is as well to compare the volume of the nitrate precipitate found with one that has been obtained from a nitrate solution of known strength.

In conclusion, it would probably be advisable that greater care should be followed in the use of saltpetre for colouring and preserving foods; and that the amount should be restricted, as far as possible, to not more than 2 grains per pound as a maximum. Two grains per pound is quite sufficient to give meat an attractive red colour. The amount absorbed in the pickling process of meats varies in a marked degree, and, as already pointed out, there seems to be no definite relation between the amount of nitre contained in the brine and that which will be absorbed by different pieces of meat; so that the consumer is constantly exposed, unless care be taken, to the likelihood of ingesting more than the physiological dose, with the risk of subsequent intestinal or renal irritation. It is fair to state that the amount of saltpetre present in the later samples of meat supplied for Army use, seems to be considerably less than that present in samples prepared some years previously. Pickling brines containing a large percentage of saltpetre should be avoided, 1 per cent. being ample. For military supplies, which are intended for prolonged use, there is little doubt that the inclusion of a salt of this nature is not without its dangers.

TYPHOID BACILLI AND THE WATER-BOTTLE.

By Major W. S. HARRISON and Lieutenant A. D. FRASER.
Royal Army Medical Corps.

In the March (1907) number of the Journal, Major Norman Faichnie gives it as his opinion that a water-bottle once contaminated with *Bacillus typhosus*, may remain so for a considerable time, although frequently washed out with fresh water, and he even goes so far as to describe the water-bottle as "a perfect typhoid-trap." The experiments which he describes in support of this contention do not seem to have resulted in the actual isolation of typhoid bacilli from the water-bottle, and his opinion appears to be based upon the isolation of *B. coli*, occasionally, from old water-bottles. As the matter is of some practical importance, it seemed desirable to put it to the test of deliberate experiment. To this end the following experiments were made.

Experiment I.—An old enamelled iron water-bottle was obtained from the local Quartermaster's stores. It was at once filled with water and inoculated with 5 cc. of a forty-eight hours' broth culture of a recently isolated strain of typhoid bacilli. A few hours afterwards the bottle was emptied, and refilled, ordinary tap-water being always used, and the bottle being kept at room temperature. The emptying and refilling was subsequently done at intervals of twenty-four hours. After each change of water the contents of the bottle were examined as follows: 50 cc. samples were taken and introduced into MacConkey and Hill's bile salt medium, which was then incubated at 37° C. for twenty-four hours. From the growth thus got litmus-lactose agar plates were stroked and incubated, any likely colonies being then picked off and introduced into broth. The broth cultures were then put through the usual tests to verify their nature.

The result of this experiment was that the typhoid bacillus was isolated after each of the first four changes of water, but never subsequently.

Experiment II. was carried out with the same water-bottle, which was again inoculated with $\frac{1}{2}$ cc. of the same strain of bacillus as that used in Experiment I. The water was changed as before, and after each change $\frac{1}{2}$ cc., 1 cc., 2 cc. and 5 cc. samples were examined in the same manner as in the previous experiment.

The result of this experiment was that the *B. typhosus* was isolated in all the samples taken after the first change of water, but was not again found in any sample taken after subsequent changes.

From these results it appears that, under ordinary conditions of use, a water-bottle contaminated with typhoid bacilli becomes pure in the course of at the most three or four days, and that, so far as typhoid fever is concerned, there is no urgent necessity for the issue of the new and elaborate sterilisable water-bottles of the types described by Faichnie and Tate; though it may be granted that these are desirable from an æsthetic point of view, as tending to do away with the unpleasantly stale taste which water acquires in an ordinary water-bottle, if it is not occasionally washed out with a few ounces of Condy's fluid.

THE DISPOSAL OF SULLAGE WATER IN INDIA.

By Captain J. DORGAN.
Royal Army Medical Corps.

In the January number of this Journal for 1907, Lieutenant-Colonel McGill pointed out the difficulties involved in the sanitary disposal of cookhouse slops and other waste waters in India. In enumerating the methods in use at the present time, he explained fully the defects of each, and suggested remedies, including possible treatment on bacteriolitic lines. For this reason I thought the following detailed account of a system which I have been elaborating during the past three years in Poona, together with the practical results of its actual working, might be of interest.

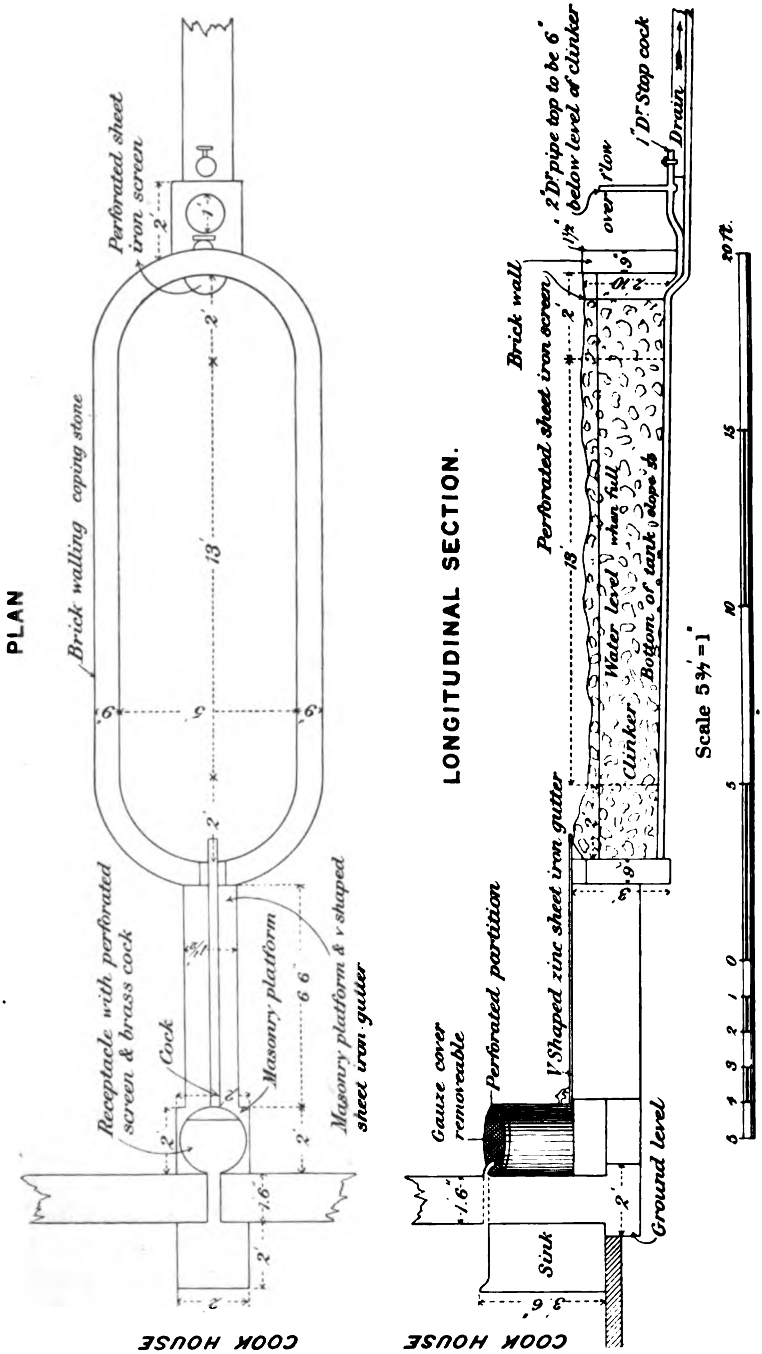
The accompanying plan, with a description, has already appeared in the *General Annual Sanitary Reports, India*, 1905. It has been reported on favourably by mixed Boards of Medical and Engineer officers. The complete system has now been in use for over three years in the No. 2 Section Hospital, Poona (sixty-two beds.)

The system consists in :—

(1) Purification of the cookhouse slops by : (*a*) Primary filtration through coarse sand ; (*b*) secondary purification in an aerobic filter bed.

(2) Disposal of the effluent and other waste waters by : (*a*) Subsoil absorbent channels ; (*b*) broad surface irrigation or regular drainage system.

Description (See plan).—*Purification of cookhouse slop water.* —The cookhouse sink, which should be placed inside the cookhouse, drains by a 2-inch pipe into a receptacle fixed immovably outside ; this is fitted with a fly-proof gauze cover, and is provided with a false bottom and a removable partition, which is perforated in its lower half. It is filled for the depth of about a foot with coarse sand. The slops strain through this sand and the perforations of the partition and the bottom, the clarified water passes from the receptacle by a small tap, and is carried by a fine pipe on to the filter bed. The filtering material is best made of burnt furnace clinker, in coarse lumps of from 1 to 2 inches in diameter. The water from the receptacle, as it arrives at the filter, is received on to the top of a pyramidal heap of the clinker, into the depth of which it should immediately pass, with the least possible amount of visible surface wetting. The filter is provided with an



Aerobic Tank (Filter Bed) for Cook House.

overflow pipe, placed at such a level that it is impossible that the upper 6 inches of the filter can ever be reached by the water, all exposure of the slops being thus prevented. The exit end of the filter is fitted with a movable tap and a 2-inch pipe which leads to the drain. The effluent, when the filter is working well, should be practically devoid of all smell, and almost as clear as tap water. The average results of repeated analysis have unfortunately been mislaid on my leaving India. The purification averaged about 50 per cent. The effluent did not undergo putrefactive changes when incubated for several days.

Disposal of the Effluent and other Waste Waters.—Subsoil absorbent channels. In the Section Hospital, Poona, I disposed of the purified effluent in the following manner (with it I also disposed of the entire waste bathroom water, which is, of course, many times greater in volume). I utilised an existing stone drain, which had been in use to carry off the bathroom water to a nullah. The drain was about 100 yards long. The adjacent ground was apparently most unsuitable for absorption purposes, there being outcrops of rock almost all over the surface, but at one part, for about 20 yards length of the drain, some depth of soil was found. The purified cookhouse slops and the untreated bathroom water were disposed of invisibly in this small space.

Channels were dug outwards from the side of and somewhat underneath the main drain; each channel was at first about a foot wide and a foot below the level of the bottom of the drain. Each was in communication with the drain by a small opening, such as would be made by slightly separating adjacent stones, but the continuity of the drain should not thereby be disturbed. These channels extended outwards about 5 yards, becoming wider and deeper, being about 4 foot wide and deep at the end farthest from the drain. Their size and direction will depend on the nature of the soil as regards its absorbing powers, and also on the quantity of water to be absorbed. I found four such channels sufficient in all weathers for the combined flow of bathroom water and cookhouse effluent. If it be desired to get rid of the latter only, a much less absorbing area is sufficient. The channels were filled to within a foot of the surface with waste Indian roofing-tiles, arranged roughly with the convexity upwards so as to maintain the maximum of free spaces. Above the tiles, and up to the level of the surface, the earth was replaced. Some grass or shrubs might well be planted.

It seems incredible with what avidity the soil, if properly prepared, drinks in long and deep draughts of water, not only in the

dry weather, but in the heaviest monsoon. After three days of the greatest downpour during the 1905 rains, when it had rained 5 inches in three days, a board of officers found the ground still capable of absorbing the cookhouse effluent, as well as the combined flow from all the hospital taps flowing for ten minutes.

Routine Management.—The sand in the receptacle, contrary to expectation, does not appear to need changing oftener than every few months. Even at the end of this period there is no smell. The upper scum is removed by the sweeper about once a week. The top of the receptacle should only permit a small, steady flow on to the clinker, in order to prevent splashing and fouling of the surface.

The conical heap of clinker, which receives the clarified water in the filter, may need rebuilding every couple of months, and at longer intervals the portion of filter bed around it may need renewal and clearing, to prevent fouling of the top layer. The remainder of the bed does not require changing. Lately I tried a section of sand near the exit end of the filter; it seemed useful in preventing the outflow of small portions of bacterial scum detached by the current of water.

The filter is filled and emptied by the cook by means of the tap. Any neglect on his part would be indicated by the overflow pipe coming into action. The actual times of contact and aëration will vary according to the times the meals are served. The filter will remain open all night. I have adopted the following hours, and found them to be convenient, and to give good results, but they may be varied within wide limits, and a third opening might be arranged for in the afternoon, though it does not appear necessary :—

Close tap at (1) Reveillé; (2) at 1 p.m.

Open tap at (1) Mid-day; (2) at Tattoo.

The small holes leading from the main drain to the absorbent channels may at times need cleaning with an iron rod, and if this is not sufficient, the first portion to the extent of about 2 feet may be opened up and the tiles replaced. If a trap is used in the upper drain to intercept leaves and silt, it will rarely be necessary to open up the channels.

The routine management is handed over to the hospital sweeper, and, with commonsense supervision periodically, the system works automatically.

Other Methods of Disposal.—The cookhouse effluent alone may be used for watering gardens, it being free of pathogenic organisms, and it does not form a greasy scum on the ground. The effluent is so disposed of in the Station Hospital, Kirkee.

In a double company cookhouse at Poona, the effluent flows into the ordinary surface stone drains and thence to a flowing stream.

Bathroom water is at present in India almost universally disposed of by soaking into irrigation gardens, or over the ground adjacent to barrack rooms. The fact that such water contains a certain amount of fæcal matter and urine, makes such a system an ever possible factor in the causation of Indian enteric fever. It has not been mentioned as a potent cause as far as I know, but this constant pollution of the ground outside barrack rooms, often by infective water, appears to be a danger which has not received due attention. I have endeavoured to minimise it by sending this water immediately beneath the surface. I have not endeavoured to treat it by filtration, as, owing to its irregular flow and the large quantity, it could not practically be done, and at best its harmful properties would only be diminished, not destroyed.

Expense.—The filtering plant would cost about 50 rupees. The drain would be extra according to length required. If the water has to be removed to a distance, a 2-inch pipe would be found more efficient and economical, but in most cases it should be possible to dispose of the cookhouse effluent, at least, in the immediate vicinity, provided that the channels are dug to the best advantage. The present insanitary system of removal costs for India at the lowest estimate £10,000 annually, and at best only about one-half of the slops are really removed. This sum could be saved by the adoption of some modification of the scheme I have outlined above. The capital expense would be repaid in from two to six months.

The size given on the accompanying plan is about sufficient for a double company cookhouse, or for a hospital of 100 beds. It may be found more suitable in some cases to bring the effluent from different filters in the lines to a central absorbing ground.

The system may be adopted in whole or in part, and is open to many modifications on the above general lines. The installation should be placed on open ground and in full sunlight as far as possible, and kept neatly whitewashed, the main idea being the minimum exposure of the slops until purified, and then the rapid and continuous disappearance of the clear water from what is apparently an ordinary stone drain.

THE ADVENT OF CRAW-CRAW IN THE ANGLO-EGYPTIAN SUDAN.

By Captain HOWARD ENSOR, D.S.O.
Royal Army Medical Corps.

At Meridi, a station of the Sudan Government situated in the Bahr-el-Ghazal Province, near the Nile and Congo watershed which forms the frontier line between the Anglo-Egyptian Sudan and the Congo Free State, several cases of a skin disease which is evidently contagious have occurred among the troops in garrison.

Seven cases have, up to the time of writing, been observed at Meridi; one of these was in the person of an Egyptian clerk and the other six occurred among the black soldiers of a detachment of the 12th Sudanese Regiment.

The disease, as seen at Meridi, begins somewhat suddenly with an eruption of papules which give rise to intense itching. These papules in the beginning of the disease are usually situated on the legs and thighs, and extend in two or three days to the genitalia, buttocks and loins; in two cases the papules first made their appearance on the arms and spread from thence to the trunk; in no case were any papules seen on the face. The eruption becomes complete by the end of the third day, and about this time vesicles begin to form in some of the papules which have first appeared, and after a day or two these vesicles become much enlarged and pustular. The intense itching complained of during the first few days of the disease impels the patient to scratch these vesicles, and as a result they are usually soon broken; when this occurs small circular ulcers form, having a diameter about equal to that of a threepenny-piece and presenting a base very definitely raised above the level of the surrounding skin, soon becoming covered with crusts which present an apperance very similar to those seen in yaws, or, to give this disease its scientific name, frambœsia. The eruption of papules referred to above was, however, neither preceded nor accompanied by any constitutional disturbance such as fever, pains in the limbs, &c., as is sometimes, though not invariably, the case with yaws. This, together with the fact that no papules appeared on the face and no relapses occurred, rendered the diagnosis from frambœsia a matter of little difficulty.

The majority of the papules seen in the seven cases under dis-

cussion did not form vesicles, and in two of the cases no vesiculation of the papules occurred at all, and the eruption entirely subsided in the course of a few days. In the negro soldiers affected by the disease, the skin immediately surrounding the vesicles appeared to be unaffected, but in the one case which occurred in an Egyptian, a zone of inflammation could be distinctly observed round each papule which had become vesicular. Doubtless a like inflammation also occurred in the case of the negroes, but owing to their skin being black it was not noticeable. The treatment adopted was the daily washing of the skin with soap and hot water, and the application of iodoform ointment to the affected areas. Sulphur ointment was tried in the first case which came under treatment, but had little, if any, effect; and in consequence iodoform ointment was given a trial and proved very successful.

Under this treatment most of the cases were completely cured in from twelve to fifteen days, and the itching complained of during the first onset of the disease soon subsided. The above symptoms combined with previous experience, have led me to believe that this disease at Meridi is identical with that known as craw-craw. This is the more probable when the fact that this part of the Bahr-el-Ghazal was, until recently, partially occupied by the troops of the Congo Free State, is taken into consideration. Many of the troops of this State are natives of West Africa, where craw-craw is very prevalent, and the disease has in all probability been introduced into this part of Africa through their agency.

It is the opinion of many that craw-craw cannot with justice be described as a definite disease. The belief has probably come into existence because the negroes in West Africa indiscriminately call nearly all skin diseases craw-craw, the word itself belonging to one or other of the numerous languages spoken on the West Coast of Africa. If this belief has gained credence on this account, it certainly appears to me that the denial of the existence of a definite disease, properly known as craw-craw, rests on very slender grounds. All that can be inferred from such reasoning is that the West African negroes do not possess intelligence of a sufficiently high order to enable them to distinguish between the different forms of skin disease. Such proof is quite unnecessary to those of us who are familiar with our black brethren in that part of the world.

It appears to me that, as many competent observers have described what they consider a distinct disease under the name of craw-craw, it can with justice be maintained that a definite disease,

see p. 691

characterised by the appearance of an eruption of papules, which become vesicular and finally pustular, does exist, and is the disease which should be understood when the term craw-craw is made use of. It would be a great improvement if some other more descriptive term could be applied to this disease, and the confusion which the present name gives rise to thus avoided.

Scheube considers craw-craw to be probably "nothing more nor less than scabies." Itch is one of the most common diseases in the Bahr-el-Ghazal, and also in the other provinces of the Anglo-Egyptian Sudan; but no cases of itch presenting the same features as the cases whose description has been attempted above, have ever before come to my notice during five and a half years' service with the Egyptian Army.

If this disease, which I have taken the liberty of diagnosing as craw-craw, were in any way a form of itch, it is only reasonable to suppose that some of the very many thousands of natives of the Sudan who suffer from inveterate itch would have presented symptoms similar to those described above as occurring in the seven cases at Meridi, would have come to the notice of some of our officers serving with the Egyptian Army, and would have been reported before this as a peculiar form of skin disease, if not actually diagnosed as craw-craw. Also all the cases at Meridi occurred, with one exception, among troops under discipline, among whom itch is not allowed to exist; as sooner or later any soldier suffering from it is certain to be detected at the weekly medical inspections. As a rule, however, Sudanese soldiers report for treatment as soon as they become infected with itch, barrack-room opinion being distinctly unfavourable to anyone who might wish to conceal such a disease. In cases of itch the tunnels made by the female acarus can usually be detected, and sometimes the insect itself can be extracted and identified; it is, however, by no means easy to do this in very chronic cases. In all the cases diagnosed as craw-craw at Meridi every case was taken to exclude the possibility of its being due to the itch acarus. Sulphur also, which is a most successful remedy for itch, failed to exercise any favourable influence on the one case in which it was tried; this can be considered a point, although a small one, in favour of this case being in reality one of craw-craw.

The literature on craw-craw is, as may be expected in the case of a disease which is never fatal, somewhat meagre, and the cause of this unpleasant skin affection is still quite unknown.

O'Neil from West Africa reported in 1875 the discovery of

a worm in the papules of this disease, and suggested that this parasite might be the exciting cause. The worm was identified by Manson as a *Filaria perstans*, but its presence can be accounted for as accidental, and as being in no way concerned with the causation of the disease, as this variety of filaria is extremely common among the negroes in West Africa.

F. Plehn, in 1898, reported from the Cameroons that he had found the *Staphylococcus pyogenes aureus* in the skin ducts in cases of craw-craw, and this observer succeeded in inoculating the disease by means of exudation taken from ruptured pustules, thus establishing its infectivity; but entirely failed to reproduce it by means of inoculations of pure cultures of the staphylococcus obtained from the skin-ducts. At Meridi, examination of films of fluid taken from unruptured vesicles showed the existence of large numbers of what appeared to be staphylococci, having regard to their microscopic features only. Their presence can, however, be satisfactorily accounted for as due to infection of the skin by the nails of the patient when scratching the affected areas. Examination of blood-stained fluid expressed from the papules was negative with regard to the presence of any kind of parasite.

Craw-craw is, as all are aware, a disease of comparatively little clinical importance; but the fact that it has hitherto been described as only occurring in West Africa may make this discovery of craw-craw, or what is at any rate a very similar disease, in the Bahr-el-Ghazal a matter of perhaps some interest to those working at African diseases.

Note.—Another case of craw-craw has occurred since this article was written, and the fluid taken from a pustule showed, in addition to staphylococci, large numbers of a diplococcus. Many of these diplococci were seen lying within the pus cells, and they then have the appearance of the *Diplococcus gonorrhœæ*, but are somewhat larger. It has been impossible to study this diplococcus further owing to the absence of the necessary apparatus.—H. E.

LIEUTENANT-COLONEL COTTELL, R.A.M.C., ON "HEART DISEASE AND THE SERVICE."

By Lieutenant-Colonel R. R. H. MOORE.
Royal Army Medical Corps.

Lieutenant-Colonel Cottell finding a whip placed in his hands, has applied the lash vigorously, but not, I think, with sufficient discretion or discrimination, in his article on "Heart Disease and the Service," which appeared in the November, 1907, number of this Journal.

No one can doubt the extreme value of the figures he has published, taken as they are from the valuable statistical records of Chelsea Hospital; but the use he makes of them, and the conclusions he draws from them, are, I think, open to adverse criticism in many respects. He is not satisfied with the way in which the recruit is enlisted, he is not satisfied with the way the recruit is trained, nor with the way the soldier is invalided for heart disease, and he thinks that if certain suggestions of his were carried out, a great saving to the State would be the result. This is wholesale denunciation which, if justified, must cast grave discredit on all the officers of the Royal Army Medical Corps. The question is, is this denunciation justified? I am sure there are many recruiting officers ready and willing to reply to Colonel Cottell's remarks on the first two points, and I will gladly leave these portions of the subject for them to deal with, and confine my remarks to the subject of invaliding.

I think Colonel Cottell's most important point, and the point that must strike the casual reader most strongly, is his contention that there would be a great saving to the State if more time were taken in observing cases of heart disease before cases are invalided from the Service. Colonel Cottell has tabulated in a series of tables a large number of the cases of heart disease, classified as "D.A.H." and "V.D.H.," that were invalided from the Service in the seven years 1895 to 1901, inclusive; it would have been better for many reasons, and more in accordance with statistical methods, if the number of cases taken from the "conditional list" had been the same in all the tables allotted to their class. Let us now examine these tables and see how many men would have been saved to the Service if more prolonged time had been given to observing them; and first with regard to "V.D.H."—I gather from what he says

on p. 470, that Colonel Cottell is in favour of invaliding, as soon as possible, all cases of valve lesion except "mitral systolic;" he cannot, therefore, advocate more prolonged observation for these cases.

With reference to "mitral systolic" cases he makes three statements (pp. 472 and 473), as follows: (1) "Practically about 26 per cent. of all the cases that could be traced tend to get sufficiently well to be able to do the duties of a soldier." (2) "Seven to 10 per cent. of invalids for mitral systolic disease get absolutely well, it would appear, and would be fit for any duties at home or abroad." (3) "If we gain, by a better and more prolonged observation of heart cases, to such an extent as for . . . . and 'mitral systolic,' say another 20 to 25 per cent. on our present invaliding . . . ." But why this diversity in the figures employed? I will explain. 26·2 per cent. is the proportion of men found fit for duty at home, on the Reserve of course, one year after invaliding (Table X.). But what is the use on the active strength of a man who is fit for home service only? We are often told that our Army is small, but that it makes up in efficiency what it lacks in size. Is there any place in such an Army for a man who is fit for home service only? 9·9 per cent. is the proportion found "apparently quite well" in from one to six years after being invalided (Table IX.). This is the utmost possible gain that Colonel Cottell can claim, and this amounts to 49 men out of 917 invalids in seven years (Table IX.). But even this number, small as it is, must be reduced, for these men were found "apparently quite well" at times varying from one to six years after invaliding, and no one would concede him more than the number found "apparently quite well" at the end of the first year. That is, according to Table VIII., 35 out of 933, or 3·7 per cent.

With reference to "D.A.H.," he says in paragraph 4 of his summary, p. 473: "Over one-third of the cases invalided for 'D.A.H.' were found to be fit for duty one year, and two-fifths were almost recovered two years, after invaliding." I may remark that none of the tables say anything about men being "fit for duty," the expressions used are "improved" and "apparently quite well"; both elastic terms, which it is easy to stretch beyond their legitimate meaning. What I have quoted appears to be a deduction from Table VII. But if so, I think it will be found that there is a considerable error in the calculation. Referring to this table, and adding together the cases shown as "improved" and those shown as "apparently quite well" at the end of one year, we get 89 out

of a total of 347, which instead of being over one-third is very little over one-fourth. But who will accept the view that the men shown as "improved" were in all respects fit for duty? If we take the "apparently quite well" only, the figure drops to about one-eighth, or 40 out of 347. "Two-fifths," he says, "were almost recovered two years after invaliding." Here again we have the "improved" added to the "apparently quite well." But even if it were as stated, it surely cannot strengthen his argument, for he nowhere advocates keeping them for the intervening two years, and, after all, "almost recovered" is not quite equivalent to quite well.

If we admit for the sake of argument, what is by no means proved, that all the men shown as "apparently quite well" at the end of the first year after invaliding, would have turned out efficient soldiers had they not been invalided, then Tables VII. and VIII. show us at a glance the number of these who were lost to the Service. By referring to these tables we find that out of 347 cases of "D.A.H." and 933 cases of "V.D.H." invalided in the seven years under review, only 40 of the former and 35 of the latter were thus lost. I think that such a result speaks very highly for the careful and efficient manner in which the invaliding of the soldier for heart disease is carried out. In cases which present so many points of difficulty, I think we might have been prepared for a larger margin of error; the figures I have quoted are surely little, if at all, in excess of what I may perhaps call the margin of safety. I do not therefore think that Colonel Cottell's tables bear out his contention that there would be a great saving to the State if a longer period of observation were given to these cases.

The next point is the length of time men are kept under observation prior to being invalided for heart disease. In Table III. are tabulated 819 cases of "V.D.H.," and Colonel Cottell finds that the average time under observation prior to invaliding for 174 Indian invalids was 4·8 months, and that the time was under two months for 19·6 per cent. of them. Commenting on this he says, ". . . the time given, especially to Indian invalids, was far too short; 4·8 months was the average time, with as short a period as only two months, for 19·6 per cent. of the Indian invalids for 'V.D.H.'" Now in Table VIII. 933 cases of "V.D.H." are tabulated, while in Table III. there are only 819. For the purpose of striking an average it would surely have been better to have included all the cases. But Colonel Cottell admits having omitted "a few exceptional cases where the disease was diagnosed from one to several years prior to invaliding." Of

course the omission of these cases—their number is not stated—vitiates the result arrived at, and robs the figures given of their value as an average figure. Further, it is admitted that the exceptional pressure of the South African campaign tended to lower the figure below the normal. But I will put all this on one side and look at the matter from another point of view.

As we have already seen, Colonel Cottell advocates "invaliding as soon as possible" in all valve lesions except "mitral systolic." Why, then, does he take exception to 19·6 per cent. of the Indian invalids being disposed of in so short a time as under two months? Surely some of these cases belong to the class in which he favours immediate invaliding? I think we will all agree with Colonel Cottell that certain cases of heart disease should be invalided as soon as possible. These are the obvious cases; other cases are more doubtful and should be kept longer under observation. This is the common-sense view, it is the one adopted in practice, and indeed, I cannot imagine any other method being followed. But Colonel Cottell lumps these two classes together, classes admittedly demanding opposite methods of treatment, and strikes an average figure. The figure is, of course, worthless for the purpose for which it is intended.

I have no means of knowing how many of the 174 Indian invalids were cases requiring immediate invaliding; but let us suppose that the 19·6 per cent. which took on the average under two months, belonged to this class. Well, 19·6 per cent. of 174 equals 34 cases: by deducting these from the 174, allowing to each a month and a half, and making a short calculation, we find that the average time given to the invaliding of the remaining 140 was 5·6 months. As some of these took shorter and some longer, it is quite obvious that a considerable number must have been under observation a good deal over six months.

It is, I think, impossible to lay down any fixed time for the observation of cases of "V.D.H.," but for my part I think that six months should be ample for all save the most exceptional. In my opinion the above figure, far from showing any carelessness or hurry, demonstrates, on the part of the officers concerned, a very lively appreciation of their responsibility.

But with what object does Colonel Cottell recommend that a longer period of observation be given to these cases? His whole object, as it appears to me, is to diminish as far as possible the chance of any man being invalided while there is still a possibility of his being able to serve the State as a soldier. This is, of course, largely a question of diagnosis; the diagnosis in the majority of

cases settles the question. But surely six months or less is quite sufficient for diagnosis in all cases except the most exceptional; and if a case is doubtful at the end of six months, I think it is very likely to be still doubtful at the end of nine. I cannot understand such a point being made of the necessity for a long period of observation at home, of men who have already undergone a long period of observation abroad. The officers who have sent the man home are in the best position to gauge his capabilities as a soldier, because they see him under working Service conditions. They have the power of testing him on the spot. They have at first hand the evidence of his having broken down, of his inability to perform the duties of a soldier. When an invalid comes home he is seen under artificial conditions; he is leading an idle life in hospital, and is at his best. In what other class of life are men given a complete rest for six months to enable them to recover from a simple valve lesion, say "mitral systolic," the result of an attack of rheumatic fever? The soldier gets better treatment in this respect than any other class, except perhaps the very wealthy; and what is the result of this prolonged rest, with a long sea voyage at the end of it, if he is serving abroad? The result is that he arrives at Netley with compensation perfectly established. He feels no inconvenience from the lesion, because he has no opportunity of testing himself. He is otherwise in the best of health, and he tells you that he feels as well as he ever did. Such cases, and they are far from uncommon, are the crux of the whole matter. What is one to do with such a case? A practitioner in civil life who was fortunate enough to get his patient into such a satisfactory condition, by long rest and careful treatment, would no doubt caution him that for the future he must lead a quite life, that he must avoid all violent exercise, all violent excitement, all sudden strain, &c. Having succeeded in establishing compensation, he would be very careful to do all in his power to maintain it.

In the Service how are we to deal with a man of this kind? Are we to pass him back into the ranks, where he has to go through gymnastic courses, where he is exposed to the strain of carrying his equipment on route marches, and to the violent exercise of "doubling" in marching order? Such a man may improve still further, he may be equal to all light labour in civil life, he may even be shown as "apparently quite well" one year after invaliding, but he would never be passed as fit for active service.

I have quoted the above case as one in which the lesion is undoubtedly organic. But there remain a certain number of cases

where there is a mitral systolic bruit, and where it is yet extremely difficult to say whether the bruit is due to organic disease, or whether it is merely functional. These are the really difficult cases, and opinions will differ as to what should be done with them. But I believe I am justified in saying that they are not invalided hastily, nor without due care. There are no accurate statistics of these cases; from their nature this would be impossible; but I think we may conclude that they form the greater part of the cases that are sent home for "V.D.H.," and discharged to duty after arrival at home. According to the Army Medical Department Reports, in 1903 and 1904 respectively, there were 106 and 176 sent home from India for "V.D.H."; of these 89 and 151 were discharged from the Service. Seventeen men in the first year and 25 in the second were returned to duty. Out of those invalided from India for "D.A.H.," the numbers returned to duty for the same two years were respectively 47 out of 105, and 72 out of 141.

Colonel Cottell seems to have quite persuaded himself that the conditions of civil life are much more unfavourable to heart derangements than life in the Army. This is, I believe, opposed to the teaching of the past, and to the opinion generally held at present. I must confess that I hold the opposite view, and I think that the killing, or compensation-breaking-down power of, say, a 200 yards "double" in marching order, far exceeds that of most of the "drawbacks," or "hardships," or "temptations," of civil life. Indeed, Colonel Cottell provides a curious commentary on this belief of his when he says (p. 468): "Note especially how early a marked improvement in the state of the heart and general health combined, takes place after invaliding." It is certainly strange that it should be so, if the conditions of civil life are as injurious as Colonel Cottell would have us believe. This is not the only place where he speaks of the early improvement that takes place after invaliding; on p. 469 he says, "any marked tendency to improvement in a case, is seen within a very short time after invaliding"; and again on p. 473 we read, "Cases of 'V.D.H.' (mitral systolic, with no general symptoms) and 'D.A.H.' that improve so much after invaliding, tend to do so in the early months."

All these statements seem to bear out the idea that civil life cannot be so injurious after all. But how does Colonel Cottell know that the improvement takes place in the early months? The tables give no information about a man's condition until a full year has elapsed from the date of his being invalided.

see Page 257

HEART MUSCLE FAILURE.

By Captain J. H. P. GRAHAM.
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Recent work done in connection with the physiology of the heart gives increased importance to a careful consideration of the musculature of the organ when investigating a case of heart disease. One result of these investigations has been to show that the rhythmic action of the heart is dependent on fundamental properties of the muscle cell; and, in so far as the initiation and completion of its cycle is concerned, the heart is largely, if not entirely, independent of extrinsic agencies. The fundamental properties of the muscle cell—rhythmicity, excitability, conductivity, contractility and tonicity—are held to be mutually independent, and can be influenced singly in a positive or negative direction. Thus, while excitability may be modified (*bathmotropic* influence), contractility (*inotropic* influence) and other properties may be undisturbed. The precise nature of the "stimulus matter," which arises in the muscle cells and initiates the cardiac contraction, has not been ascertained, but the conclusions of Loeb, drawn from the behaviour of muscle in the presence of certain ions, are mentioned by Wenckebach as indicating that the whole cycle of events is of a chemico-physical nature. The stimulus matter is built up in the cells and produces a contraction, the onset of which exhausts or destroys the stimulus matter, which must be built up afresh before the next physiological contraction can occur. The orderly and efficient action of the heart is thus seen to be primarily dependent on the integrity and functional activity of its muscle fibres, which are liable to be either directly or reflexly affected by many outside influences. It does not, however, appear that organic change in the muscle fibres is essential to impair their processes. The researches of Aschoff and Tawara go to prove that nutritional disturbance or toxic states in the course of acute or chronic disease, without inducing general parenchymatous changes in the myocardium, can impair the functional activity of the muscle. The practical value of these investigations arises from the fact that they invite closer attention to the muscle element in all heart cases, and emphasise the error of using the terms "heart disease" and "valvular disease" as if synonymous and interchangeable; they also help to a better understanding of those

numerous cases of heart disease due to muscle failure alone. The mechanism whereby *valvular* disease causes stenosis or incompetence, and their immediate and remote effects, are at once obvious. But the *muscle* element does not seem always recognised as being able, *per se*, to bring about very similar conditions, and in *valvular* cases does not obtain full recognition as an immediate cause of circulatory embarrassment. When valvular disease has been diagnosed, the phenomena present seem sufficiently explained by the assumed state of the valve without assessing the share of muscle failure in their production. Yet, as an eminent authority points out, a large class of cases of heart disease, accompanied by venous stasis and endocardial murmurs (particularly apical systolic), is due to muscle failure alone; while many valvular cases are much more *muscle* than *valve* cases, and in all valve cases it is by the myocardium alone that a *modus vivendi* is established.

In simple rheumatic endocarditis, for instance, the early signs of circulatory derangement which occur, are certainly more often due to muscle failure and the dilatation to which it leads, than to structural changes in the valves. At this stage the changes in the valves found *post-mortem* are usually quite inadequate to account for the degree of circulatory embarrassment of which there have been abundant signs during life. Moreover, the structural changes in the valves, which in simple endocarditis eventuate in stenosis, or it may be in incompetence, are slowly progressive and remote. On the other hand, the venous stasis and endocardial murmurs, which come on abruptly and early in rheumatic and other infective fevers (septic endocarditis excepted), and which, under suitable conditions, are completely recovered from, are sufficiently accounted for by muscle failure. In presence of muscle failure, dilatation is always likely to exist. Not only is the degree of ventricular contraction diminished, but the sphincter-like action of the muscle in lessening the auriculo-ventricular orifice and approximating the valve segments, fails; the action of the papillary muscles in rendering the valve segments taut, is also to some extent lost. If the valves fail to receive adequate support from the musculature they do not remain competent, regurgitation into the auricles occurs, the auricles in turn dilate, and in extreme cases become merely passive reservoirs. Even short of such conditions, ventricular dilatation and asystole often result, in which case the ventricle at the end of systole not only contains an amount of blood in excess of the physiological

residuum, but it has been shown that an increased expansion takes place during diastole. The tone is impaired, so the degree of contraction following the increased diastolic expansion is lessened; a fact in accord with the physiological rule. To what extent structural changes in the valves eventually share in causing circulatory derangement, even in valvular cases, may, in particular instances, be difficult to decide, but available evidence encourages the belief that in the early stages, and in many chronic cases of valvular disease, the muscle element is largely responsible for the troubles that arise, while it alone is at fault in cases of valvular incompetence not dependent on structural valve disease. Possibly in rheumatic fever the infective agent has more than a single action, one product inducing a chronic inflammatory reaction in the valves, another manifesting itself as an acute functional poison to the muscle cells. In this way it is possible to explain the muscle failure which arises without gross myocardial change. The immediate result of muscle failure is to establish a disproportion between the work of the heart and its power to do it. The ultimate result depends very largely on the condition of the cardiac nutrition and the circumstances in which the patient is placed. In acute disease, it has been remarked above that the onset is often abrupt and the sequence of events rapid. Often, however, the condition is developed insidiously, due to injurious influences acting over protracted periods; the muscle, either from causes impairing its nutrition, or in the presence of a chronic toxæmia, fails to meet the demands made on it. Conditions within and without the body often combine to bring about the result. In people past middle life, the subjects of chronic Bright's disease, arterial degenerative processes and allied conditions, chronic muscular inadequacy often obtains. Even in presence of cardiac hypertrophy, so often found in these cases, relative inadequacy and mitral incompetence frequently exist. In these cases the cardiac nutrition is gradually disordered from a variety of causes, among which must be included a chronic toxæmia, which almost certainly exists; extra work is thrown on the heart owing to increased resistance in the systemic circulation. The influences at work here lie chiefly within the body. In young adult males and grown men, when all such cases can be excluded, it is not unusual to find instances of mitral incompetence, which it seems only reasonable to regard as relative in kind, and originating in pure muscle failure. If the history of these men is carefully gone into, it will generally be found that they are engaged in more or less

laborious occupations, and were unfitted or unprepared for physical strain when they first had to meet it. Perhaps they had taken to manual labour after a period of unemployment and privation, or sickness, while still in an unfit condition. In short, circumstances have combined to cause these men to throw stress on the heart muscle at a moment when the latter was not in a condition to meet it, nor to gradually accommodate itself to its work. These conditions, moreover, have often obtained at an age-period when the heart is yet developing, hardly *pari passu* with the skeletal muscles, and is consequently susceptible to overstrain. Debility and anæmia are not infrequent in young males, and if present aggravate the conditions generally. These conditions may, of course, entail an acute transient breakdown; but more often they establish a degree of chronic cardiac inadequacy, which possibly does not always produce marked symptoms, and the signs may only be discovered by accident.

A dubious history of long antecedent acute rheumatism may be obtained, but what probably determines the condition is the combination of circumstances named. In this manner a condition of the mitral valve is established which approximates to the well-known "safety-valve" action of the tricuspid. Here, again, owing to loss of contractile power, a tendency towards ventricular dilatation is set up, and if the muscular support to the valve ostium is lost, relative mitral insufficiency is established. Under favourable conditions this state of things may be transient and quickly recovered from, that is, if a general improvement in physical conditions obtains and keeps pace with the increased work, or if the work can be accommodated to the capacity of the heart. But in other circumstances the relative insufficiency persists, or even becomes aggravated, or at best compensatory hypertrophy occurs, even in presence of which a relative insufficiency may remain. That is to say, the hypertrophied muscle only suffices to deal with the increased load of blood thrust on it by dilatation and increased diastolic expansion, but is insufficient to overcome the yielding of the valvular ring, so regurgitation still persists. Under fortunate circumstances and appropriate treatment the more chronic cases may recover, or a balance may be maintained between heart power and work, which enables the individual to continue in certain forms of employment. There are other cases which, under any conditions, go from bad to worse, and nothing seems able to stave off the final disaster; rare as such a condition is, apart from rheumatic origin, probably in these rapidly pro-

gressive cases strain has induced sclerotic changes in the mitral valve.

With regard to diagnosis little can be said. Often the only complaint made is "short-windedness," often the condition is discovered by accident; this, of course, in milder or compensated cases. But in severe cases almost any degree of venous stasis may exist, together with a loud and diffuse systolic murmur. A gallop-rhythm is frequently present, and is regarded by many as of diagnostic importance. The pulse is always frequent and quick (*P. frequens et brevis*), and on inspection of the chest a great deal more movement can often be seen than felt. Two opposite conditions are found—either a diffused, weak impulse, particularly the diastolic impact of the right ventricle, or a short, quick, exaggerated impulse of the left ventricle. "Functional" murmurs are said to be limited and not prolonged into the axilla, but this is probably not universally true. As might be expected, the subjects of this condition are often anæmic; but just as often they appear to be in good general health, that is, in the milder instances. In fact, each case has to be judged on its own merits, for, unfortunately, there is nothing pathognomonic of the condition.

The paper by Lieutenant-Colonel Cottell in the November (1907) issue of the Journal, which is most interesting to any one specially interested in the subject of heart disease, seems to confirm many of the opinions advanced in this note, particularly those dealing with the cause and effect of muscle failure in "non-valvular" cases.

In conclusion, it may be mentioned that the views here expressed were formed by the writer chiefly during a period of several years' service in a large infantry depôt and recruiting centre.

THE PREVENTION OF MALARIA IN BRITISH POSSESSIONS, EGYPT, AND PARTS OF AMERICA.[1]

(REPORT TO SECTION VII. OF THE FOURTEENTH INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY HELD IN BERLIN, SEPTEMBER, 1907.)

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I.—PRELIMINARY.

ALMOST exactly ten years have now elapsed since the parasite of malaria was first detected in anophelines. This discovery, confirmed and amplified in many countries, suggested many methods for the prevention of the disease; but unfortunately, although science may indicate methods of prevention, local Governments are not always willing to undertake the trouble and expense required for the work. It is very advisable, then, to examine how much various Governments have actually done during this period in several parts of the world to preserve mankind from the vast amount of sickness and mortality occasioned by so widespread a malady, and to consider what action may be taken to encourage more energetic efforts in the future. In attempting this task, however, I propose to confine my remarks to those countries in which the progress of events is best known to me—that is, principally to the Tropics; but at the same time fear that I must give the history in considerable detail, without which my conclusions will not perhaps be as clear to others as they seem to be to myself.

In 1897-99 I was able to observe in several parts of India that

[1] Also printed in the *Lancet*, September 28th, 1907.

numerous species of anophelines (in two of which I had previously cultivated the crescent-bearing parasites) breed mostly in natural collections of water lying upon the surface of the ground, and not, as many other common varieties of gnats do, in vessels and cisterns.[1] This fact at once suggested the full explanation of the laws known from the time of the ancients—that malaria is generally connected with terrestrial water, and may be reduced by drainage. But at the same time, while it re-established the old prophylaxis by drainage, it rendered it more simple, cheap, and yet precise. No longer driven to the expensive task of draining the whole expanse of a malarious area, we were now able to confine our operations, often with a great saving of money, only to those particular pools which are suitable for the larvæ of the insects, and which in many places I had already observed to be comparatively few and small. Consequently, I did not hesitate to advise the Government of India, (in a report dated February 16th, 1899), to adopt this important measure in the principal malarious towns and military stations.[2] [3] At the same time, as already empirically known, the use of mosquito-nets during sleep was obviously a valuable means of personal prophylaxis. Shortly after writing this report I left India, and a few months later (July, 1899) proceeded with two colleagues, Dr. H. E. Annett and Mr. E. E. Austen, to the British Colony of Sierra Leone, where we hoped to indicate more exactly the details of this perfected system of drainage-prophylaxis. We immediately ascertained, by my methods previously elaborated in India, that *Pyretophorus costalis* and *Myzomyia funesta* carry all the species of the parasites of man in that part of Africa; that these mosquitoes breed principally in small but numerous collections of water on the ground; and that it would be a comparatively easy task for the authorities, with all the resources at their disposal, to remove these breeding-places within the city of Freetown, and thus to reduce the mosquitoes and the malaria together. In order to help them in this task, we indicated for the first time the peculiar attitudes of the anopheline larvæ and adults which enable anyone to recognise them at sight; the special characters of the pools in which they breed;

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[1] Ross, "Instructions for the Prevention of Malarial Fever," Liverpool School of Tropical Medicine, *Memoir* I., 1899; and "Researches on Malaria," Nöbel Publication, 1902, Stockholm; German Translation, Gustav Fischer, Jena.

[2] *Ibid.*, "Extermination of Malaria," *Indian Medical Gazette*, July, 1899.

[3] *Ibid.*, "The Possibility of Extirpating Malaria from Certain Localities by a New Method," *British Medical Journal*, July 1st, 1899.

and the exact methods by which these pools should be dealt with; and we furnished them with a complete map of the principal breeding places. Our reports gave the original full exposition of the anti-mosquito prophylaxis of malaria, which since then has become the basis of all such work in many parts of the world.[1] [2] Not being authorised, however, to undertake the work ourselves, all we could do was to advise, and we then returned to England hoping that the Government would act upon our suggestion.

In the meantime my Indian researches had been followed with enthusiasm in Germany and Italy. In the autumn of 1898 Koch and the Italian observers, who had made so many beautiful studies of the subject, were able to confirm and to extend the original investigations. They immediately suggested another great system of malaria-prophylaxis—that by quinine. It was argued that if all the persons in a community who suffer from malaria are sought out and efficiently treated with quinine, the parasites will diminish so greatly within the community that the mosquitoes, however numerous they may be, will no longer become infected, and will thus cease to convey the infection to healthy persons. Without delay the Germans, led by Koch, and the Italians, led by Celli, sought to give practical effect to this logical suggestion. At the same time, Celli especially advocated the general protection of houses by means of screens of wire gauze.

It is not my function to-day to follow the labours of these distinguished workers. The problems in malarious British Colonies, which are mostly tropical and inhabited by dark races, is not the same as in Italy—a fact which is often forgotten by academical sanitarians. Such races cannot easily be persuaded to submit to continued medication by quinine, and are much too poor to provide screens for their houses, and even Europeans in the Tropics frequently reject both measures with obstinacy. On the other hand, drainage-prophylaxis demands no such compliance from the public. As I have frequently pointed out,[3] local authorities can drain, or otherwise treat, anopheline pools without asking the consent of anyone. The people are not required to take any drug for months, or to pay for expensive appliances in their windows. Moreover,

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[1] Correspondent (Ross), "The Malaria Expedition to Sierra Leone," *British Medical Journal*, September 9th, 16th, and 20th, and October 4th, 1899.

[2] Ross, Annett, Austen, "Report of the Malaria Expedition to West Africa," Liverpool School of Tropical Medicine, *Memoir* II., 1900.

[3] Ross, "Mosquito Brigades." George Philip and Son, London, 1902.

mosquito-reduction tends to remove yellow fever and filariasis, as well as malaria, banishes a source of constant personal irritation, and, no less important, compels local sanitary departments to keep a close watch on all parts of the area in their charge. On the other hand, of course, we cannot expect drainage to be undertaken everywhere, in the open fields or the wilderness; it is principally applicable to towns—that is, to places where the money spent upon it is likely to benefit the largest number of people; for the camp, the farm, the plantation, the isolated house, and the petty hamlet, the other measures must frequently be fallen back upon. As a rule, however, for tropical towns mosquito-reduction, where it is possible, has always promised to be the most useful and, in the end, the most economical system of all; and, of course, the other measures may often be adopted, at least partially, in addition. Thus the ideal procedure for towns in the tropics consists (1) in the removal of mosquito-breeding waters; (2) in the treatment of old cases of malaria with quinine; and (3) in the protection, as an additional safeguard, of hospitals, barracks, jails and as many houses as possible, with wire gauze. To these we must add, as insisted upon by Stephens and Christophers, the principle of segregation for Europeans.

But however desirable mosquito-reduction seemed to be, my proposals to adopt it were everywhere met at first with objections. One objection was that the breeding waters must be so numerous that their suppression would be too costly an undertaking, even in towns; and those who held this view forgot that to exsiccate a town would generally be a far less formidable engineering task than to give it a pipe water-supply or a sewerage system, while in dry climates it might prove a very easy task indeed. Another objection, and a still more extraordinary one, was that local mosquito-reduction would be useless, owing to the immigration of mosquitoes from outside. This is as much as to say that the population of an area would not be decreased by the abolition of the birth-rate within that area; but in spite of the unreasonableness of the objection, it was repeated everywhere for years and did not disappear until it was dealt with mathematically, first by myself,[1] and then more fully by Professor Karl Pearson and Mr. J. Blake-

[1] Ross, "The Logical Basis of the Sanitary Policy of Mosquito-Reduction," Congress of Arts and Science, St. Louis, U.S., 1904, and *British Medical Journal*, May 13th, 1905.

man.[1] Repeated over and over again, in spite of the clearest disproof, these objections have done much to check anti-malaria work throughout the world, and have also been often used, I fear, to cover the inertia or indifference of officials.

II.—Campaigns in West Africa.

I will now proceed to describe briefly the progress of events as known to me. As already stated, in 1899 I visited Sierra Leone with two colleagues, and advised the authorities exactly regarding the best means of reducing malaria in the capital, Freetown. Immediately after this visit, the Liverpool School of Tropical Medicine despatched, on my advice, a number of gentlemen—Dr. R. Fielding-Ould, Dr. Annett, Dr. J. E. Dutton and Dr. J. H. Elliott—to various West African Colonies (British Gambia, Sierra Leone, Gold Coast, Lagos and Nigeria), in order to make similar studies. Later the Royal Society sent, also on my advice, Dr. J. W. W. Stephens and Captain S. R. Christophers, I.M.S.; so that by 1901 a fairly accurate survey of the malaria was made in many towns along that deadly coast, and measures for prevention were formulated.[2] In most cases it was comparatively easy to take these measures. Thus in Sierra Leone our suggestions of 1899 were not really difficult. The town contains only about 30,000 inhabitants, and though, owing to the large rainfall, to a rocky substratum to the soil, to numerous flat areas, and to the existence of many badly-constructed surface drains and gutters, there were many anopheline pools, yet almost all of these were so small that a little cutting or filling up with gravel or concrete would suffice for their abolition. I suppose that £20,000 would have paid for the exsiccation of the whole town, with an annual maintenance expenditure of, say, £500, but a great deal of good could have doubtless been effected with much smaller funds. For example, many of the holes in the soil, which were the principal source of the anophelines, could have easily been filled up by small gangs of labourers working constantly under the local municipal engineering and sanitary departments, without any

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[1] Pearson and Blakeman, "A Mathematical Theory of Random Migration," *Drapers' Company Research Memoirs*, University of London. Dulau and Co., London, 1906.

[2] Various Authors: Liverpool School of Tropical Medicine, *Memoirs* II., III., IV., and Royal Society Reports to the Malaria Committee, July 6th and August 15th, 1900.

elaborate general drainage scheme. Considering that the whole prosperity of the place, long known as the "white man's grave," had been checked by the malaria, we had reason to hope that at least some serious consideration would be given to our suggestions.

For a year and a half after our departure, however, little appears to have been done. We heard that one man had been employed to treat the pools, but that his services had been dispensed with later. At this time the objections to prophylaxis by mosquito-reduction were being so loudly uttered by those who had not sufficiently considered the matter, that I felt that the whole of this invaluable sanitary policy was in imminent danger of being lost to the world, in spite of all the arguments which had been used in favour of it. For example, so good an observer as Rogers[1] said, in 1901, that "Very few authorities now consider it feasible to reduce malaria materially by the destruction of anopheles"; and even at the last meeting of this Congress[2] Celli remarked, that while the laboratory experiments of himself and Casagrandi for the destruction of mosquitoes were encouraging, yet "in the wide field of practice, the difficulties were such that we could scarcely by this means, unless in exceptional cases, obtain in our country the suppression of malaria." Fortunately at that moment (early in 1901) a Scotch philanthropist offered me £2,000 to defray the expenses of giving an object-lesson in the methods of mosquito-reduction. This generous gift, augmented by several friends to the cause, was accepted with gladness and gratitude, and I determined to return at once to Sierra Leone and to commence, myself, the measures which I had previously recommended. Of course it was not possible that with £2,000 I could actually succeed in ridding Freetown of malaria, but I hoped at least to demonstrate the feasibility of the measures, and trusted that when they were once begun the local Government would not hesitate to continue them. Accordingly in June, 1901, I left England for Freetown with Dr. M. Logan Taylor, who was to carry out the work under my general instructions.

On arrival we found everything in nearly the same condition as when I had left the Colony two years previously. Scarcely any of the breeding-pools had been done away with; owing to

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[1] Rogers, *Journal of Hygiene*, October, 1901, p. 415.

[2] Celli, Thirteenth International Congress of Hygiene and Demography at Brussels, 1903.

faulty sanitation the backyards of the houses were filled with rubbish, such as broken bottles and old tins, in which innumerable mosquitoes were propagating; the hospitals were not protected with gauze; general quinine prophylaxis was not insisted upon, even among officials; and there were no trustworthy statistics to measure the actual amount of malaria present. Dr. Taylor attacked the work with great energy, employing, occasionally, over fifty men at a time, to which the local authorities contributed a gang of twelve men, and carts and implements. A large number of breeding-pools were rapidly dealt with; innumerable cartloads of rubbish were removed from the houses, and the people were advertised of the dangers caused by mosquitoes. Although there is no known method for estimating exactly the number of mosquitoes within a given area, we felt ourselves justified in concluding from general observation that these measures had produced a marked diminution in the insects. Dr. C. W. Daniels, of the London School of Tropical Medicine, inspected the work shortly after its commencement, and reported (October 1st, 1901): "In my opinion, already your efforts have been crowned with a large degree of success, as there has been a noteworthy diminution in the number of the first two genera" (*Anopheles* and *Stegomyia*) "found in the houses. The number of breeding grounds has been enormously diminished."[1] Dr. Taylor continued the work for the whole of the next year, under the varying conditions of the wet and dry seasons, and used the money at his disposal to its fullest advantage. But, as I have said, with our limited funds, our attempt was intended merely as a commencement, which, it was hoped, would be followed up energetically by the local authorities with the much greater resources which they possessed—and I stated this clearly in my report on the affair. I have no doubt that if this had been done malaria would have been practically banished from the town from that date. Unfortunately, as Dr. Taylor's time grew to a conclusion, he was obliged to report unfavourably upon this point, and we therefore determined with regret to put an end to our efforts in that Colony.[2] A year later the authorities roused themselves sufficiently to ask for a public inquiry into the whole matter, but as we objected that they had probably allowed all his

[1] Ross, "First Progress Report of the Campaign against Mosquitoes in Sierra Leone," Liverpool School of Tropical Medicine, *Memoir* V., Part I., October 15th, 1901. With letter by Daniels.

[2] Taylor, *ibid.*, Part II., September 15th, 1902.

work to fall into abeyance in the interval, the proposal was quashed. At this time, moreover, the brilliant campaign at Ismailia began to develop, and there was no longer any need for private individuals to sacrifice their time and their health in the attempt to help those who were obviously not very anxious to help themselves.

In the meantime the new ideas had been gradually gaining ground, and public prophylaxis against malaria had been started with more or less vigour in several localities. Passing over, according to my intention, the German and Italian work, I will commence with that of Sir William MacGregor, M.D., Governor of Lagos, to whom belongs the honour of having been the first British Governor to comprehend the full importance of recent discoveries and to act upon them. As early as 1900 he made a careful examination of the evidence upon which they were based and, being himself a medical man well skilled in many sciences, became quickly convinced, and then determined to take action at once. Lagos is an important town of West Africa, built in the midst of lagoons and marshes and possessing a large negro population. Ably seconded by his Principal Medical Officer, Mr. W. H. W. Strachan, Sir William MacGregor commenced by instituting numerous public lectures on the subject, and by founding a ladies' league, the object of which was to reduce the large infantile mortality by quinine. At the same time he issued an order by which the prophylactic use of the drug was made compulsory for all public servants, and led the way by taking it with regularity himself. Efforts were then made to induce all the wealthier inhabitants to screen their houses, and most of the public buildings were shortly guarded in this manner, at least partially. Next, turning his attention to drainage-prophylaxis, he filled up marshes, and dealt with the shallow margins of lakes and lagoons in which the mosquitoes bred most readily. Similar measures were ordered along the line of railway into the interior; and when I visited the Colony in 1901 I was a witness of the vigour and capacity with which the work was being conducted. Unfortunately his health now began to break down, and his services were soon lost to the tropics, where his great knowledge and his warm enthusiasm for the high cause of sanitation had promised to do so much. At his departure that cause suffered a blow from which it has not yet recovered.[1]

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[1] MacGregor, "Notes on Anti-Malarial Measures now being taken in Lagos." *British Medical Journal*, 1901. Also Strachan, *British Medical Journal*, September 17th, 1904.

Except in Lagos, little had yet been attempted in the other West African Colonies, in spite of the surveys already mentioned. But when I revisited Sierra Leone in 1901, I was able to extend my tour not only to Lagos but also to the Gold Coast and to the Gambia, and to suggest to these latter Colonies campaigns similar to that projected in Freetown. To start the work, in 1902 Dr. Taylor was sent to the Gold Coast[1] and Dr. Dutton to the Gambia,[2] so that in 1903 anti-malaria measures were at least commenced in all these Colonies, and I hoped that a few more years would witness the salvation of that rich but unhealthy land from the plague which had so long oppressed it. I may add that in 1904, by the generosity of King Leopold, Dr. Dutton and Dr. J. L. Todd were sent to the Congo Free State to investigate and to advise there also.[3]

Unfortunately, I cannot say definitely how far our hopes have been realised. The official reports and figures[4] are not sufficiently exact and copious to enable us to judge with certainty either regarding the measures which have been taken by local Governments or of the results, if any, which have followed. It is stated[5] that malaria fever has decreased among the British troops in West Africa during 1905. The admission-rate was only 59 per cent., against 84 per cent. in 1904 and an average of 139 per cent. for the eight proceeding years; and the Senior Medical Officer remarks that the improvement is "attributed to the anti-malaria measures adopted during the last three years." But it is characteristic of these very incomplete publications that we cannot even ascertain where exactly the troops were stationed. On the other hand, we hear frequently from merchants and travellers in West Africa that the general health of Europeans has greatly improved, as shown by the decrease of death and invaliding among employees, miners, &c. For example, there has been a remarkable change, to judge from statistics kindly furnished to me by Mr. F. Shelford, in the health of men working on the Lagos railway. In the past it frequently

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[1] Taylor, "Report on the Sanitary Conditions of Cape Coast Town," Liverpool School of Tropical Medicine, *Memoir* VIII., 1902.

[2] Dutton, "Report of the Malaria Expedition to the Gambia," Liverpool School of Tropical Medicine, *Memoir* X., 1902.

[3] Various Authors, Liverpool School of Tropical Medicine, *Memoirs* XIV., XV., and XX.

[4] "Colonial Reports, Annual." Wyman and Sons, London.

[5] Army Medical Department Report for 1905, p. 138. Harrison and Sons, London.

happened that the percentage of days spent on the sick list by men employed on railway construction in West Africa was as high as even 10 or more per cent. During 1905 and 1906, however, the figure has been down as low as 1·12 per cent., and was always under 2 per cent. (on the "extensions").

III.—Campaign at Ismailia.

Let us now proceed to consider more decisive campaigns elsewhere. But first let me refer to that great scientific discovery which gave so much indirect assistance to the prevention of malaria —the discovery of Finlay, Carter, Reed, Carrol, Lazear, Agramonte, Ross and others, that yellow fever also is carried by mosquitoes. It is true that, though both diseases are mosquito-borne, the prophylaxis is widely different owing to the different habits of the stegomyia and the anophelines, to the rapidity of immunity in yellow fever, and to its resistance to quinine. Nevertheless, the case of the one helped the case of the other. No sooner was the stegomyia definitely incriminated at the end of 1900 than the American Government of Cuba, under General Leonard Wood, himself a medical man, set to work with a promptitude, energy, and intelligence not always visible in other Governments, to use the facts which science had just placed in their hands. Except for a slight recent recrudescence, which we hope will shortly be conquered, the disease was practically swept out of the island from that date. This event occurred in 1901, just at the time when Dr. Taylor and myself were commencing our attempts at Sierra Leone. Owing to the examples so set, similar campaigns now began to be started in various parts of the world. Perhaps the most classical and brilliant one was that of Ismailia commenced in 1902, which gave a complete and perfect demonstration of the possibility of banishing malaria and mosquitoes together.

The town of Ismailia was founded by the great Ferdinand de Lesseps in 1862, at a little distance from the middle point of the Suez Canal and close to the Salt Lake, Timsa. Though built in the midst of the desert, which surrounds it everywhere with its ridges of white sand like the undulations of a vast snowfield, it has, nevertheless, now grown to contain about 8,000 inhabitants, most of whom are employees of the Suez Canal Company. Supplied with fresh water by means of a canal from the Nile, it possesses many good houses, gardens, and well-appointed streets, kept in admirable order by the officials of the company under the able and energetic

President, Prince Auguste d'Arenberg, who himself resides here for many months every year. Immediately after the construction of the freshwater canal in 1877, malaria appeared for the first time in the town, which had been previously noted for its salubrity. The cases gradually increased in number until in 1886 almost all the inhabitants suffered from fever. In 1901 the President, having recognised the new discoveries, determined to employ them against this troublesome epidemic, and commenced by sending a member of his highly competent medical staff, Dr. A. Pressat, to Italy to study the subject. Early next year, however, shortly after the commencement of the operations at Freetown, he invited me to go to Ismailia to advise upon the best means of attacking the disease. I arrived there in September, 1902, with Sir William MacGregor, who did me the honour to accompany me, and with Dr. Pressat on his return from Italy.[1] On our arrival we found all the officials of the company keenly alive to the importance of the work. They had already detected the anophelines in the town, had urged the general employment of mosquito nets, and had commenced an active quinine prophylaxis. On the other hand, the town was still swarming with mosquitoes. Even in the house of the President, where we were lodged, there were multitudes of culex, which we showed were being bred in the well-constructed cesspit under the house; while abundance of anophelines were found in the houses of the employees, and were evidently carrying the disease everywhere in spite of the mosquito-nets and the segregation of the Europeons. I felt, therefore, that here, as in other places where I had studied the subject, we should have to introduce the radical method of mosquito-reduction if we wished for complete results, and I reported strongly in favour of this course. As Dr. Pressat has said, we formed "the conviction that we should establish for Ismailia a plan of campaign sensibly different from that which we had seen followed in Italy, where the campaign against mosquitoes occupied only a secondary rank—so that this destruction appeared to us to be the capital article of our programmes,"[2] (p. 130). We found the larvæ of the anophelines at once in various collections of water, principally in some small brackish marshes in the sand and some waters of irrigation, but happily not in the main freshwater canal, where small fish destroyed them.

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[1] Ross, "Report on Malaria at Ismailia and Suez," Liverpool School of Tropical Medicine, *Memoir* IX., 1903.

[2] Pressat, "Le Paludisme et les Moustiques." Masson et Cie., Paris, 1905.

The campaign, conducted with intelligence and energy, presented no great difficulty. The marshes were filled up with sand, the irrigation channels were deepened or treated with oil, while the cesspits were soon rendered uninhabitable for the larvæ of culex. As Dr. Pressat has said,[1] he was able to effect the preliminary work with a "mosquito brigade" of only four men, *qui a tout fait.* Although hundreds of men were employed later for large permanent works, this was only after the mosquitoes had already disappeared *grace à notre brigade de quatre hommes.* I may perhaps be pardoned for dwelling on this fact, because it fully justifies the advice which I had given more than three years previously, but which had been met everywhere with scepticism. The results were most striking. It should be remembered that as nearly all the inhabitants of Ismailia were employees of the Suez Canal Company, and as no other fever was prevalent in the town, exact statistics for many years had been possible. I give the following approximate figures from Dr. Pressat's works from the time when malaria first appeared in 1877 to 1905:—

Years	Cases of malaria	Years	Cases of malaria	Years	Cases of malaria
1877	300	1887	1800	1897	2089
1878	400	1888	1400	1898	1545
1879	500	1889	1450	1899	1784
1880	400	1890	1900	1900	2284
1881	450	1891	2500	1901	1990
1882	480	1892	2050	1902	1551
1883	550	1893	1750	1903	214
1884	900	1894	1100	1904	90
1885	2000	1895	1350	1905	37
1886	2300	1896	1150		

For more exact figures I must refer to Dr. Pressat's works. Since 1904 nearly all the cases have been relapses among persons previously infected, and last year the company officially reported that *toute trace de paludisme a disparu d'Ismailia.* Of course, the treatment of old cases has constantly proceeded parallel to the anti-mosquito campaign. But the fortunate inhabitants have been relieved not only of malaria but of the constant annoyance caused by the insects. In 1902 we were constantly being bitten in the houses. Now, as many visitors to Ismailia have testified,[2] one can sleep there without nets. This does not imply that the insects are absolutely unknown in the town, but only that their numbers have

[1] Pressat, "Prophylaxie du Paludisme dans l'Isthme de Suez," *La Presse Médicale*, 30 Juillet, 1904.

[2] Boyce, "The Anti-malaria Measures at Ismailia," Liverpool School of Tropical Medicine, 1904.

been very greatly reduced. Absolute extirpation is scarcely possible without bonification over a very wide area, but, as mathematically shown, reduction to a small percentage is much more feasible, and there are evident logical reasons for supposing that the amount of an insect-borne disease must ultimately vary *cæteris paribus* as the square of the number of the insects. The cost of the work has been officially reported [1] as being about 50,000 francs for the original drainage and filling up of the pools, with an annual expenditure of 18,300 francs for the mosquito brigade, oil, maintenance, &c. This amounts to an initial expenditure of about 6·25 francs and an annual expenditure of about 2·3 francs per head of population—a small price to pay for the benefits given.

It has been said by the opponents of mosquito reduction that the success at Ismailia was not real, but merely consisted in the statistical transfer of cases from the heading of malaria to that of other fevers consequent on better diagnosis. This is untrue, as there is no other fever there. It has also been said that the success was due to the exceptionally easy conditions at Ismailia. True, the conditions are not so difficult as in places like Panama and Sierra Leone, but I have seen many areas where they were quite as easy as in Ismailia but where nothing whatever has been done. The success at Ismailia is absolutely unquestionable. It is due chiefly to mosquito-reduction and also largely to cinchonisation. We owe it entirely to the intelligence and capacity of Prince d'Arenberg and his excellent staff.

IV.—Campaigns at Klang and Port Swettenham.

Commenced even before the campaign at Ismailia, as ably conducted and almost as decisive, the work at Klang and Port Swettenham in the Federated Malay States, is an equally distinguished example of the radical method of malaria reduction. Klang is a town on 3,576 inhabitants (in 1901), situated on the banks of the river of the same name in the State of Selangor, on a flat, swampy area lying between the river and a semicircle of low hills. In September, 1901, as the navigation of the river to Klang presented difficulties, a new port called Port Swettenham was opened five miles down the river from Klang, on an area reclaimed from mangrove swamp. The population of the two settlements together was about 4,000 in 1903, while that scattered through the

[1] "Official Report of the Compagnie Universelle du Canal Maritime de Suez, Suppression du Paludisme à Ismailia," 1906.

surrounding district was about 14,000. The rainfall averages about 100 inches (three metres) a year. The full history of the campaigns in these two towns is given in the excellent papers by Dr. M. Watson, the district surgeon, and Mr. E. A. O. Travers,[1 2 3 4] the State surgeon. In the latter part of 1901 malaria became very serious in both towns, and, according to Dr. Watson, perhaps not more than three houses in the whole of Klang escaped infection, while the workmen at Port Swettenham began to leave the place. Dr. Watson immediately set himself to collect statistics, to observe the local anophelines, and to take the preliminary steps for the campaign. Supported by Mr. Travers and the Sanitary Board and by the intelligence and liberality of the Government, he soon obtained realisation of the recommendations of himself and his colleagues, made on the lines laid down by me ([2], p. 349). At Klang work was commenced in 1901 by extensive clearing of undergrowth, followed by drainage in the next year. The swamps in the town were rapidly filled in, and a contour drain to intercept the inflow from the surrounding hills was cut. At Port Swettenham forest and mangrove swamp were felled, and a complete drainage scheme, prepared by the State engineer, was carried out. In both towns, pending completion of the drainage, mosquito brigades were appointed, and their employment was extended subsequently under the name of "town gardeners." When the epidemic had already begun to subside (p. 353) wire-gauze was supplied to many of the houses and an active quinine distribution was commenced. All the measures have been well maintained since then.

As regards cost, Mr. Travers and Dr. Watson state that at Klang it amounted at the end of 1905 to a total of £3,100, with an annual expenditure of £210 for town gardeners and £60 for clearing drains. For this money 332 acres (134 hectares) have been dealt with, including virgin jungle, dense secondary growth, and swamp. At Port Swettenham the total cost has been £7,000 to the end of 1905, with an annual upkeep of £140. For this 110 acres (45 hectares) of mangrove swamp were drained, and a considerable area

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[1] Travers, "An Account of Anti-malaria Work . . . in Selangor . . ." *Journal of Tropical Medicine*, September 15th, 1903.

[2] Watson, "The Effect of Drainage and other Measures on the Malaria of Klang, Federated Malay States," *Journal of Tropical Medicine*, November 16th and December 1st, 1903.

[3] *Ibid.*, Second Report, *Journal of Tropical Medicine*, April 1st, 1905.

[4] Travers and Watson, "A Further Report . . ." *Journal of Tropical Medicine*, July 2nd, 1906.

has been levelled, partly to provide building sites. The cost per head of population has therefore amounted to about £1 4s. up to the end of 1905—a very small charge considering the heavy rainfall and the dense vegetation of the country. These towns did not possess the exact statistics of Ismailia for a long period previous to the campaign. Great credit is therefore due to Dr. Watson for the care and skill with which he has determined the results of his measure.[1] The following table is compiled from the figures given by him :—

RESULTS OF THE ANTI-MALARIA CAMPAIGN IN KLANG AND PORT SWETTENHAM.

(From the *Journal of Tropical Medicine*, July 2nd, 1906, by Mr. Travers and Dr. Watson.)

Population of Klang and Port Swettenham about 4,000 in 1901 and now largely increased. District population 14,000 in 1901. Anti-malaria campaign commenced (only in Klang and Port Swettenham) in 1902.

(1) *Cases of Malaria admitted to Klang Hospital from the Two Towns compared with those admitted from the District.*

Years	1901	1902	1903	1904	1905
Towns	610	199	69	32	23
District	197	204	150	266	353

(2) *Deaths in Klang and Port Swettenham.*

Years	1900	1901	1902	1903	1904	1905
Fever	259	368	59	46	48	45
Other diseases	215	214	85	69	74	68

(3) *Deaths registered in District, excluding Towns.*

Years	1900	1901	1902	1903	1904	1905
Fever	173	266	227	230	286	351
Other diseases	133	150	176	198	204	271

(4) *Infected Children in Towns and District.*

November and December, 1904.

	Klang	Port Swettenham	District
Children examined	173	87	298
Children infected	1	1	101

November and December, 1905.

	Klang	Port Swettenham	District
Children examined	119	76	247
Children infected	1	0	59

(5) *Sick Certificates and Sick Leave Granted to Government Employees.* (Numbering 176 in 1901 and 281 in 1904.)

Years	1901	1902	1903	1904	1905
Certificates	236	40	23	14	4
Days of leave	1026	198	73	71	30

To these figures Dr. Watson adds,[2] that so great has been the reduction of the malaria that he has lost a large part of his private

[1] Watson, Second Report, *Journal of Tropical Medicine*, April 1st, 1905.

[2] *Ibid.*, *Journal of Tropical Medicine*, April 1st, 1905.

practice as District Medical Officer. Regarding the reduction of mosquitoes he remarks[1]: "A definite improvement in the health of Klang was evident when only the swamps nearest to the main groups of houses had been dealt with, and while other swamps within the town were still untouched. The mosquitoes from these did not appear to travel any distance, and there has been no evidence of dangerous immigration of anophelines from the extensive breeding-places which, until the middle of 1904, existed just outside the town boundary, and some of which still remain. Yet the species breeding in these swamps were identical with those breeding within the town."

The objection raised against the campaign at Ismailia—namely, that it possesses a dry soil and climate—cannot be raised against the well-conducted campaigns in the Federated Malay States, and the world owes a debt of gratitude to the Government of these States, to Mr. Travers, and especially to Dr. Watson, for the fine example which they have set.

(*To be continued.*)

[1] Watson, Second Report *Journal of Tropical Medicine*, April 1st, 1905.

Clinical and other Notes.

A NOTE ON TWO CASES OF PARATYPHOID FEVER IN WHICH A NEW VARIETY OF PARATYPHOID BACILLUS WAS FOUND IN THE BLOOD.

By Major J. G. McNAUGHT.
Royal Army Medical Corps.

Some months ago Major Statham, R.A.M.C., directed my attention to the method of making cultures from the blood of cases of continued fever by preliminary incubation in sterilised ox-bile, and plating out on Drigalski and Conradi's medium. Following this method, I recovered from the blood of two cases, neither of which had given any agglutination reaction with *Bacillus typhosus*, a bacillus of the coli-typhoid group, which does not correspond with any of the types described. I had previously recovered this bacillus from the urine of a case of enteric fever. This was the case of Private R., who was admitted to hospital at Wynberg on June 12th, 1907, suffering from fever of about a week's duration. The case was one of moderately severe type; the temperature reached normal on the twenty-sixth day of disease; a relapse, attended with symptoms of congestion of the bases of the lungs, occurred on the thirty-fourth day, and the temperature did not finally reach normal till the forty-fourth day of illness. The patient's serum gave a positive reaction with *B. typhosus* in 1—50 dilution on the thirteenth and twenty-third days of disease, and an imperfect reaction on the thirty-third day. During convalescence the urine contained a slight amount of albumin. Cultures were made from it on August 20th, 1907, and a bacilus isolated which I shall describe later on as Bacillus R.

Private H., an orderly who had been nursing Private R., became ill about September 3rd, and was admitted to hospital on September 9th, 1907. He was then suffering from severe headache, sleeplessness, and general malaise, and looked very ill and prostrate. His face was deeply flushed, eyes red and watery, pupils contracted. The headache was extremely severe, was referred to the top of the head, and persisted for a week after admission. The tongue was furred in the centre and red at the edges. The bowels were constipated all through his illness, and the motions dark in colour. A few rose spots were noticed on his abdomen when he was admitted, and during the next few days successive crops of spots appeared in very great numbers, not only on the truuk, but also on the arms, legs and feet. When the rash was at its height several thousand spots were present. Many of these spots were of a darker red than the typical rose spots, and became fixed after a day

or two. As they faded they left brown stains, which were still visible, though very faint; a month later his temperature had become normal. His illness was protracted owing to a recrudescence of fever on September 21st, 1907, associated with sharp pain in the right side, referred to the region of the gall-bladder, which was enlarged and tender. These symptoms subsided in a week, but were succeeded by swelling of the left leg, due to thrombosis.

His serum was tested for enteric fever on September 10th, 15th, 22nd, and 29th, and November 10th, 1907, but no agglutination was observed on any of these occasions. A positive but not very sharp reaction was obtained with *B. paratyphosus B.* on September 15th, 22nd, and 29th, 1907, in dilutions 1—20 and 1—50. On November 10th, 1907, no reaction was obtained.

Cultures were made from blood obtained from one finger on September 15th, 1907 (about thirteenth day of illness), and a bacillus which I shall describe further on as Bacillus H was isolated.

Private L. was admitted to hospital at Wynberg on October 18th, 1907. He had contracted his illness in Cape Town, and, so far as I could ascertain, there was no connection between his case and the two already described. He had been ill for about a week before admission, suffering from very severe headache and pains in the back. On admission, his tongue was furred, bowels constipated, spleen slightly enlarged. A few rose spots were noticed on the abdomen. Successive crops of spots appeared in the course of the next few days, the rash resembling that described in the case of Private H., but being less profuse. Many spots appeared on the forearms, legs and feet, a number being noticed on the soles. Some of the spots left brown stains, which persisted for weeks. His illness was short, the temperature falling to normal on the sixteenth day; a slight rise occurred on the nineteenth and twentieth days, associated with acute pain and tenderness in the region of the gall-bladder, though I was unable to detect any enlargement of that organ. During convalescence his pulse was persistently slow, averaging only 40 per minute. No jaundice was present.

His serum was tested for enteric fever on October 20th and 28th, 1907, in dilutions 1—20 and 1—50, with negative results; on November 10th, 1907, a very slight and imperfect reaction was obtained in these dilutions. On October 20th and 28th, 1907, a positive reaction was obtained in 1—20 dilution, but not in 1—50 dilution, with *B. paratyphosus B.*

On October 19th, 1907 (about eighth day of illness), cultures were made from finger-blood, and a bacillus was isolated which I shall describe as Bacillus L.

Clinically, the two cases of which I have given a short description, struck me as showing distinct variations from enteric fever. This was especially noticeable in the case of Private H., where the severe head-

ache, injected suffused eyes and general prostration, made one at first suspect the onset of small-pox or typhus fever. The occurrence of pain in the region of the gall-bladder at about the same day of disease in both cases may have been merely a coincidence, but, if so, was rather a striking one. The rash in both cases was peculiar, it was partly a rash of ordinary rose spots, and partly of dark red spots which became fixed. Lieutenant-Colonel Heffernan, R.A.M.C., tells me that he was struck last year by the occurrence at this station of several cases of short, anomalous continued fever, associated with a similar profuse rash.

The following table shows the characters of the bacilli isolated from the three cases referred to.

	Bacillus R	Bacillus H	Bacillus L
Drigalski and Conradi's medium	Bluish small colonies ..	Bluish colonies; after a few days became greyish and raised in centre. Showed marked ridges and furrows	Similar to H.
Gelatine stab..	White growth; dry-looking expansion; no liquefaction (observed for a fortnight)	Similar to R.. ..	Similar to R.
Agar slope ..	White dryish growth, not easily emulsified	Similar to R.. ..	Similar to R.
Peptone broth	Profuse growth; marked pellicle; no indol (5 days) in cold, but slight trace after 24 hours' incubation	Similar to R, but growth less marked	Similar to R, but less profuse. Trace of indol in cold (5 days).
Neutral red broth	Growth and pellicle in 24 hours; yellow colour in 24 hours	Growth and pellicle in 24 hours; slight yellow colour in 4 days, gradually becoming deeper.	Growth and pellicle in 24 hours; yellow colour in 48 hours.
Litmus milk ..	Slight alkalinity in 48 hours; marked alkalinity in 4 days; no clotting in a week	Slight alkalinity in 4 days, distinct in 5 days; no clotting	Distinct alkalinity in 48 hours; no clotting.
Potato.. ..	Brown growth	Brown growth ..	White growth.
McConkey's bile salt broth (glucose)	Growth; no acid or gas ..	Growth; no acid or gas	Growth; no acid or gas.
Proskauer and Capaldi's media—No. 1	Growth; pellicle; marked alkalinity	Growth; marked alkalinity	Growth; marked alkalinity.
Ditto—No. 2..	No growth (?)	No growth (?) ..	No growth (?).
Morphology ..	From agar a short, stout bacillus, with rounded ends; many in pairs; motility slight. In broth longer forms found; motility very marked. Gram negative.	Similar to R. ..	Similar to R.

Bacillus H gave the following results when tested against Private H.'s serum :—

		1—20	1—50
September 22nd, 1907	(freshly isolated)	*Nil*	*Nil*
,, 29th ,,	(third subculture)	+	–
October 3rd ,,		+	+
November 10th ,,		–	–

Bacillus R with serum of Private H. :—

	1—20	1—50
October 12th, 1907	+	+

Bacillus L gave the following result when tested against Private L.'s serum :—

	1—20	1—50
November 10th, 1907	+ (Very marked)	±

Bacillus R grows more profusely than the other two in liquid media, and produces more alkali, but the variations are slight and all three appear to belong to the same type. They resemble very closely the descriptions of *B. fæcalis alkaligenes*, given by Horrocks ("Bacteriological Examination of Water," p. 192) and Savage ("Bacteriological Examination of Water Supplies," 1906, p. 106). Savage gives a number of references to the bibliography of this bacillus, and mentions the work of Altshüler and Doebert, who claim to have converted *B. fæcalis alkaligenes*, by successive passages in guinea-pigs, into *B. typhosus*. Their conclusions, however, have not been confirmed by other observers.

It is very probable that there are more types of paratyphoid bacilli concerned in the causation of continued fevers than those which are at present commonly recognised. Nicolle and Cathoire, in a paper entitled "Etude d'une Epidémie de fièvre typhoide Africaine; Existence en Tunisie des infections paratyphiques" (*Archives de l'Institut Pasteur de Tunis*, Juillet, 1906), put forward this view, and give notes of four cases of fever, which they were unable to refer to any known category from the agglutination reactions. The recovery of the bacillus I have described, from the blood of my two cases, does not prove that the fever was due to this bacillus, but gives a reasonable presumption that it was so, when we take into account the absence of agglutination with *B. typhosus*. The serum of the patients was also tested against *Micrococcus melitensis*, with negative results.

KALA-AZAR IN THE ANGLO-EGYPTIAN SUDAN.

By Captain S. L. CUMMINS.
Royal Army Medical Corps.

The first case of kala-azar discovered in the Anglo-Egyptian Sudan, was reported by Dr. Sheffield Neave in the *British Medical Journal* of May 28th, 1904. It occurred in a Sudanese boy from Meshra-el-Rek on the Bahr-el-Ghazal River, the case being diagnosed at Omdurman.

No further cases were recorded until I found the Leishman bodies in the spleen of an Egyptian soldier who died at Abbassia Hospital, Cairo, on May 16th, 1907. This man had been invalided from the Sudan, diagnosed "malarial cachexia," and a reference to his medical history sheet, demonstrated that he had contracted the disease at Singa on the Blue Nile.

A nominal roll of all Egyptian soldiers who had been at Singa with this man was obtained, and enquiries instituted. One of these men was found to be under treatment for chronic malaria in Khartoum Hospital; and Captain F. F. Carroll, R.A.M.C., kindly investigated his case, and proved that he, too, was suffering from kala-azar, the "bodies" being found on splenic puncture. Meantime another Egyptian soldier invalided from Kassala district for malaria, was thought to present symptoms of kala-azar on admission to Abbassia Hospital, and the diagnosis was confirmed by finding the Leishman bodies in spleen smears. This case was definitely traced to a small station called Mafazeh on the Rahad River, a tributary of the Blue Nile.

A circular was now sent to the Senior Medical Officers of Kassala and Blue Nile districts, calling their attention to the discovery of this disease in cases invalided from their provinces, and asking that full investigations should be made amongst both the garrisons and the civil populations. Captain L. Bousfield, R.A.M.C., had already suspected two cases in the Civil Hospital at Kassala to be suffering from this disease, and shortly after succeeded in demonstrating that one of these men had numerous "bodies" in the spleen. The other case proved fatal, but unfortunately the relatives refused to permit a *post-mortem*. There is little doubt, however, that he, too, died of kala-azar. The civilian in whom the disease was proved to exist was demonstrated to have contracted it in Abyssinia.

Captain R. B. Black, R.A.M.C., has since recorded two more cases found at Singa on the Blue Nile. Both were Arab policemen, and both appeared to have contracted the disease at Mafazeh, afterwards coming to Singa. Mafazeh is a station close to our Abyssinian frontier, where much traffic with the latter country takes place. A very sad case has also to be attributed to the Southern Blue Nile district. I refer to the recent fatal illness of an inspector of the Gordon College, who contracted kala-azar while carrying out anthropological investigations in Southern Sennar. It is believed that this case arose at Kaili, which is close to the Abyssinian frontier.

The common topographical feature of this series of cases would seem to be proximity to the hilly regions on the borders of Abyssinia. The Meshra-el-Rek case would seem at first to be an exception; but it must be recalled that an extensive traffic in spear-heads, cattle-bells and other implements is carried on between the Jur tribe, a race skilled in smelting and working the iron that exists in considerable quantities in their country, and the Shilluks and other tribes along the Sobat

River, an Abyssinian tributary of the White Nile. It is, however, too early to insist on an Eastern origin of the Sudanese cases, as further investigation may bring to light the presence of the disease in Kordofan and the Southern and Western Bahr-el-Ghazal. It is curious that Egypt seems to be free from the disease.

Dr. A. Furguson, Professor of Pathology at Kasr-el-Ainey Medical School, Cairo, informs me that in a long series of spleen examinations he has never met with the Leishman bodies.

Bed-bugs are widely spread both in Egypt and the Sudan. Samples have been collected at Blue Nile Stations and in Cairo, and sent to England for classification.

FOUR CASES OF BERI-BERI.

By Captain W. J. WATERS.
Royal Army Medical Corps.

While stationed at Kailana, India, during the summer of 1906, the four following cases were sent up to that station from Cawnpore and came under my care. They developed into cases of beri-beri. I do not think I can do better than give an extract from the notes I made at the time. The interval in the note-taking between the beginning of June and the beginning of August, was occasioned by both the case-sheets and myself being absent from the station, the case-sheets travelling up and down the Eastern Command, from office to office, for remarks; the cases then being finally decided upon as cases of beri-beri, I myself being away in medical charge of a cholera camp.

Case 1.—Private P., 1st Somerset Light Infantry, was admitted to Kailana Section Hospital on May 28th, 1906, complaining of inability to walk even a short distance without considerable exertion and shortness of breath. He also complained of shooting pains in the calves and a certain amount of numbness in the soles of the feet.

Previous History.—Patient was admitted to the Cawnpore Station Hospital about April 30th, 1906, complaining of inability to walk any distance and shooting pains in the calves. Patient was in hospital for about eight days, and was discharged with a view of proceeding to Kailana, and directed to attend hospital there on arrival. The following history was forwarded with him: "Complained of pain in, and swelling of, the calves of both legs, with weakness; knee-jerks, heart sounds and urine normal. Has been on syphilitic register since December 27th, 1905."

Patient informed me that both he and two of the following cases (Lance-Corporal C. and Private P.) slept in the same barrack-room, and not only in the same room, but next to or opposite each other, at one end of the room. This barrack-room was situated over an

institute (Royal Army Temperance Association). The plan of the building was as follows:—First floor: On the left of steps leading to the upper floor, school; on the right, Royal Army Temperance Association Institute. Second floor: Up steps on left, barrack-room; unaffected. Second floor: Up steps on right, barrack-room; affected. The three patients mentioned above as sleeping in the right-hand barrack-room were at the end of it, nearest the steps. A drinking-water tank was also at this end, which, a patient informed me, was continually leaking and keeping the floor near it damp. This was No. 10 barrack-room, and was situated at the end of the barracks, near the hospital. The native lines and regimental bazaar were comparatively near. I was also informed by the patient that the Cawnpore Barracks water supply is obtained from wells, and that latrines are situated in close proximity to them; also that the *bhistis* draw off the water required for ablution purposes the night before, and leave it exposed in the large open brick tanks attached to the wells all night.

Present Illness (at Kailana).—Patient, who is a well-proportioned man, of more than average intelligence, had the following symptoms on admission: "He walks with a halting kind of gait, slightly swaying from side to side. He lifts his feet well off the ground and brings them down flat on the ground, in place of the normal heel-and-toe movement. On turning, the swaying movements are increased, and he raises his arms away from the body to steady himself in the turn. On standing with both eyes closed, patient sways from side to side; and this he feels himself, and describes it 'as giddy, as if I was going to fall.' While standing with his eyes closed, he is unable to touch the tip of his nose with his forefinger, and misses it by about an inch with either hand. He can pick up small articles off the floor, but states 'that he has fallen down twice in trying to pick up his rifle off the ground.' The cutaneous reflexes are only slightly present, but the deep reflexes, such as knee-jerks and ankle-clonus, are absent. His pupils very slightly react to light, but not to accommodation. The circumference of the legs round the calves is little, if any, larger than normal. On pressure, patient complains of pain in the muscles, and he also states that he suffers from a féeling of numbness in the soles of his feet.

"*Eyes.—By Test Dots:* Right eye not quite normal; vision $\frac{6}{12}$. Left eye normal. *By Ophthalmoscope:* Right eye apparently normal. Left eye apparently normal.

"*Chest.—Lungs:* Both are apparently normal. *Heart:* Cardiac dulness of normal extent. First sound short in time, otherwise normal. Second sound normal.

"*Abdomen.*—All organs apparently normal. Urine normal; no albumin or sugar."

June 7th.—Patient's condition about the same; if anything, some very slight improvement since his admission to hospital. The following

alcoholic history has been forwarded from Cawnpore: "Private P. is a moderate drinker, and seems to drink about two quarts of beer a day."

There is a marked syphilitic history in this case, but at the present time there are no symptoms. The bacteriologist of the 7th Meerut Division reports that he can give no information by examining the blood in either this or the three following cases.

August 14th.—Patient has remained the same since admission. His general health keeps good. He has been on potassium iodide and mercury during the time he has been in hospital, without any obvious improvement.

August 26th.—Case-sheets returned yesterday. Condition the same.

September 18th.—Patient passed invaliding board for change to England on September 14th, 1906.

CASE 2.—Lance-Corporal C., 1st Somerset Light Infantry, was admitted to this hospital on May 21st, complaining of increasing inability to walk any distance without a considerable amount of exertion; pain in the calves and numbness of the feet.

Previous History.—Patient was admitted to the Cawnpore Station Hospital on April 23rd, 1906, complaining of swelling in the calves, especially marked in the left leg, accompanied by continuous pain in the calves and a sense of numbness in the feet, rendering him unable to perform his duties. Patient was discharged from Cawnpore Hospital on May 7th, 1906, to proceed to Kailana, and directed to attend hospital on arrival. The following history was forwarded with him: "Complained of pain and swelling of the calves of his legs; weakness; loss of knee-jerks; heart sounds muffled; urine normal."

Present Illness (at Kailana).—"The patient is a well-made, rather healthy-looking man, with some increase of adipose tissue beneath the lower jaw. He walks with a slow, halting kind of gait, slightly swaying from side to side, and raises his feet off the ground and brings them down as a whole, flat on the ground, instead of the normal heel-and-toe movement. On turning the swaying movement is increased and he finds it difficult to turn quickly. On standing with both eyes closed, patient sways slightly from side to side, but this is not marked. He states that he himself feels the swaying movement, 'as if he was likely to fall.' While standing with his eyes closed he cannot manage to touch the tip of his nose with his forefinger, but misses it by about an inch with both hands. He can pick up such articles as matches off the floor, and states that he has never fallen down while attempting this, but he makes some preparation by getting steady on his legs before attempting the picking up. The cutaneous reflexes are present, but the deep reflexes, such as knee-jerks and ankle-clonus, are totally absent. The pupils react to light, though the right eye is a little sluggish when compared with the left. There is apparently no reaction to accommodation. The circumference of the legs round the calves has increased, according to the patient's

own statement, and on pressure he complains of pain in the muscles. Patient also complains of numbness in the soles of his feet. I may mention that this man was in a barrack-room in which several cases of multiple neuritis occurred, according to the patient's and his officers' statements, and these were stated to have caused strong suspicion of attacks of beri-beri.

"*Eyes.—By Test Dots:* Both eyes have apparently normal vision. *By Ophthalmoscope:* Right eye normal; left eye normal.

"*Chest.—Lungs:* Both are apparently normal. *Heart:* Cardiac dulness is extended well to the left of the nipple line, the apex beat being external to that line and 1½ inches below the nipple; the heart being rather dilated. First sound short in time and muffled at apex, with a doubtful systolic murmur. This is marked at both the pulmonary and aortic areas. Second sound well marked at all orifices, especially sharp and distinct at the pulmonary and aortic areas.

"*Abdomen.*—The abdominal organs are apparently healthy, with the exception of the liver, which is enlarged in a downward direction. No hepatic tenderness. Urine normal; no albumin or sugar. The quantity passed, the patient states, is less in amount than previously."

June 3rd.—Patient's condition has not improved since admission, and the state of his heart remains the same.

June 7th.—Alcoholic history from Cawnpore: "Lance-Corporal C. is said to be a heavy drinker, but is now moderate, probably drinking about two quarts of beer a day." No syphilitic history.

August 14th.—There has been a fair amount of improvement. Heart is smaller, but still a little irregular. Sounds normal: the systolic murmur has disappeared during my absence in camp. Patient still complains of inability to walk far, and of shortness of breath on the least exertion. Knee-jerks gradually returning. Pupil reaction to accommodation is also returning.

September 16th.—Passed invaliding board for change to England on September 14th.

Case 3. — Private P., 1st Somerset Light Infantry, was admitted to the Kailana Section Hospital on May 19th, 1906, complaining of increasing inability to walk, even a short distance, without considerable exertion; and also of a dull aching pain in the calves on movement. His legs had also become swollen.

Previous History.—Patient was admitted to the Cawnpore Station Hospital some six weeks ago, complaining of swelling and pain in the calves of his legs and inability to perform his duty. He was discharged as "debility" on May 14th to proceed to Kailana, and directed to attend hospital on arrival. The following history was forwarded with him; "Patient was at one time suspected of suffering from beri-beri. He has had pain and swelling of calves of both legs with weakness; knee-

jerks impaired; pulmonary systolic murmur, which has recently disappeared; liver considerably enlarged; urine normal."

Present Illness. — "The patient is a stout, somewhat pale man, well developed, but with a certain amount of excess of adipose tissue. He walks with a slow, halting gait, with his feet kept some distance apart. The foot is raised off the ground and brought down as a whole, flat on the ground, instead of the ordinary heel-and-toe movement. On standing with his eyes closed he at first only sways slightly; this increases after a little while, but never to the extent of falling down. Patient himself states that he feels the swaying movement and 'wants to catch hold of something'; he also states 'that he has this feeling on a dark night.' While standing with his eyes closed he manages, with some slight hesitation, to touch his nose with the tip of his forefinger. He can pick up such things as matches easily, and states that he has never fallen over in picking up anything off the floor. The cutaneous reflexes are present, but the deep reflexes, such as the knee-jerks and ankle-clonus, are totally absent. His pupils react to light and accommodation, the latter rather sluggishly. According to the patient's statement, the legs are larger than usual, and he complains of pain in the muscles on pressure. Patient also complains of a feeling of numbness in the soles of the feet.

"*Eyesight.—By Test Dots:* Vision normal in both eyes. *By Ophthalmoscope:* Both eyes normal.

"*Chest.—Lungs:* Both are apparently normal. *Heart:* Cardiac area is extended out to the left nipple line and the heart is dilated. First sound hurried in time. It becomes, on listening for some time, rather blurred, and occasionally a pulmonary systolic murmur can be heard, but this is not marked and has to be listened for. Second sound sharp and well defined. Pulse-rate, at rest, 80 a minute (lying down).

"*Abdomen.*—The abdominal organs are apparently healthy, with the exception of the liver, which is enlarged. No hepatic pain. Temperature normal. Respirations 16 to the minute. Urine, normal; no albumin or sugar."

June 3rd.—No systolic murmur can be heard to-day, but the heart is still dilated and there is shortness of breath on the least exertion.

June 7th.—Alcoholic history from Cawnpore: "Private P. is a hard drinker. He probably drinks on an average about a gallon of beer a day." Patient acknowledges having had syphilis.

August 26th.—The progress of this case has been uneventful towards recovery. Patient still complains of inability to walk far and of shortness of breath on the least exertion. Heart sounds normal; size of heart slightly above normal. Knee-jerks gradually returning. Swaying movement not marked.

September 18th.—Patient passed invaliding board on September 14th for change to England.

CASE 4.—Private E., 1st Somerset Light Infantry, was admitted to the Kailana Section Hospital on May 21st, 1906, complaining of inflammation of the lymphatic glands of the left groin. These had been opened, but had not by that date healed. He also complained of weakness and wasting of the leg muscles and inability to raise his feet without exertion.

Previous History.—Patient was admitted to the Cawnpore Station Hospital on February 2nd, 1906, for inflammation of the lymphatic glands. He was in hospital for one hundred and two days, and was discharged on May 14th, 1906, with a view to proceeding to Kailana. According to the patient's own statement, he first noticed weakness in the legs about April 15th. The following history was forwarded with him: "No evidence that inflammation is due to venereal disease. Has been in hospital three and a half months. Wound healing." This patient states that he was living in the next bungalow to the three previous patients. There is no history of syphilis to be obtained either from his medical history sheet or from the patient. As to history of alcoholic consumption, patient states that he sometimes goes for months without taking any alcohol at all, and he may then have two or three pints of beer.

Present Illness (at Kailana).—Besides the open wound in the groin, which subsequently healed, patient had the following symptoms: "A somewhat pale, sallow-looking man, fairly well developed. Patient walks with a hesitating gait, his feet slightly apart, but there is no swaying movement, and he can turn fairly quickly. He brings his feet down rather heavily on the heel, and finishes the step off in the normal manner. On going down steps he pauses slightly before attempting to do so. On standing with both eyes closed there is a slight tendency to sway, but this is not very marked. He is also unable to touch the tip of his nose with the forefinger of either hand. He can pick up small articles off the floor, and has no tendency to fall in doing so. The cutaneous reflexes are present, and also ankle-clonus. The knee-jerk of the left leg is absent, and the right is very sluggish. Patient states that his legs are much smaller round the calves than usual, but has no feeling of numbness in the soles of his feet. He has no pain on movement, but pain in the calf muscles on pressure. His pupils react to light and accommodation, the latter rather sluggishly.

"*Eyes Testing.—By Test Dots:* Both eyes, vision normal. *By Ophthalmoscope:* Both eyes apparently normal.

"*Chest.—Lungs:* Both are apparently normal. *Heart:* Area of cardiac dulness normal. Sounds: Both normal.

"*Abdomen.*—All organs apparently normal. Urine normal."

August 14th.—Patient has not improved since his admission to hospital. The knee-jerks are now totally absent.

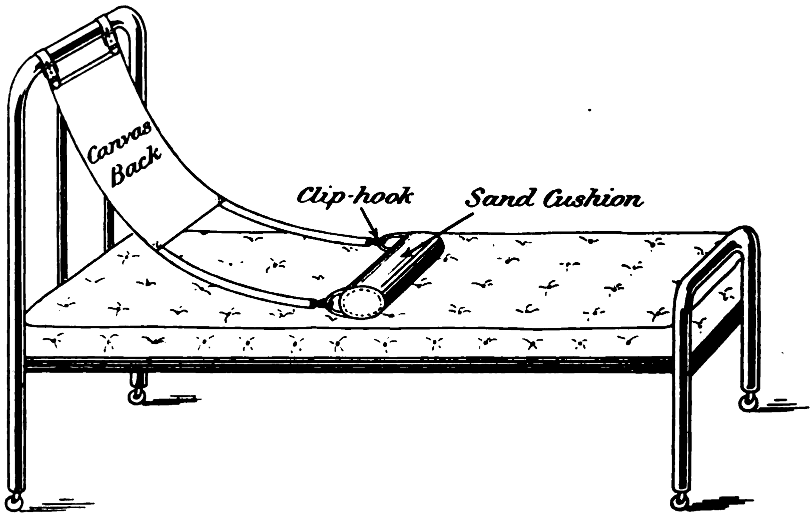
September 16th.—Patient passed invaliding board for change to England on September 14th.

A NEW PATTERN BED-REST.

By Lieutenant-Colonel H. J. R. MOBERLY.
Royal Army Medical Corps.

The bed-rest in use in our military hospitals possesses many obvious defects. It is hard, without "give," narrow, and shifts with every movement of the patient. To counteract the tendency of a patient to slip down in the bed, blocks have to be placed under the bottom legs of the bedstead. The defects enumerated are remediable. Keeping that object in view, the bed-rest about to be described has been constructed. In my hands it has been found a satisfactory appliance.

The apparatus consists of (1) the bed-rest proper; (2) the sand-cushion.

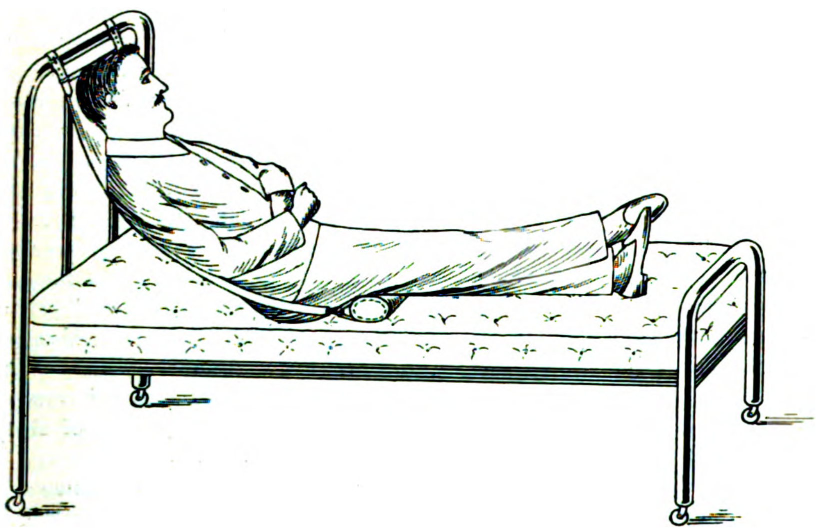


Bed-rest as suggested by Lieutenant-Colonel H. J. R. Moberly, R.A.M.C.

(1) *The bed-rest* is made up of: (*a*) A length of canvas (tent canvas is the best), 20 inches deep by 24 inches wide, including a 2-inch hem at each side. The hems open above and below; the upper opening is a slit in the canvas (fringed with a leather strengthening band stretched round the margins), and is situated about 1½ inches below the upper border of the canvas. A stick of cane is sewn in along the entire top edge of the canvas; by this means the "give" of the canvas caused by the patient's weight is lessened. (*b*) Two leather straps, 54 inches long by 1¼ inches wide. At one end of each is fixed a brass swivel hook, the other end being free. A brass buckle, 1¼ inches wide, is attached to each strap 18 inches from the extremity of the free ends.

(2) *The sand-cushion* should be 28 inches wide and 6 inches in diameter, filled sufficiently to allow of solidity in its entirety, yet not so stiff as to prevent impression on it by the patient's weight. This is important, as the presence of "give" means a minimum of discomfort in a prolonged sitting. Two stout web straps are sewn one on each end of the bag.

The apparatus is applied as follows: The sand-bag is placed well below the buttocks. The canvas (previously threaded with the straps), is placed behind or well under the patient. Swivel hooks of the straps lowermost. The swivels are now fastened to the loops in the end of the sand-bags. The free ends of the leather straps are passed round the bedtop rails and buckled off to required tightness.



Bed-rest in use to show Position of Sand-bag.

It is claimed for this bed-rest that it is inexpensive, simple in construction, easily kept clean, requires little storage space, and further, it can be made by any saddler. I am indebted to Sister Agnes, of King Edward's VII.'s Hospital, for a suggestion which enabled me to further the idea of its construction.

The dimensions of the canvas given in the foregoing are those suitable for the Bed, Mark III., as supplied to military hospitals, which have rounded corners to the top-rail. If this rail had square corners the canvas might be wider, and this undoubtedly would make the bed-rest much more comfortable.

THE THIRD CASE OF LIVER ABSCESS IN A MAN WITHIN FOURTEEN MONTHS.

By Captain W. J. WATERS.
Royal Army Medical Corps.

I am forwarding this case for the Journal, as I think it may be of some interest.

Bombardier C. was admitted to the Military Hospital, Elizabeth Castle, Jersey, on July 21st, 1907, complaining of having strained himself by lifting a shell of about 100 lb. weight.

Previous History.—While serving at Rangoon he was admitted to hospital with liver abscess, on May 26th, 1906. This emptied itself through the lungs and he was invalided to England. At Golden Hill he was twenty-six days in hospital with pleurisy, and this was followed almost immediately by fifty days for debility. Within three months he was back in hospital for seventy-two days with liver abscess, the following note being made in his medical history sheet: "Very severe, liver exposed and aspirated in eight directions, no pus found, patient much debilitated, but gained weight lately, and had no rise of temperature for some weeks." Patient was admitted to hospital at Seaforth for malarial fever, and was seventy-five days in hospital. Mention is made in the medical history sheet of this attack of malarial fever as follows: "Careful examination failed to detect physical signs of hepatic abscess, which was suspected as complicating the malarial fever." This fever, as the following notes will show, was probably due to liver abscess, patient's disease being changed to liver abscess, and another thirty-eight days being spent in hospital. "Exploratory operation performed December 29th, 1906, and final operation with evacuation of 1½ pints of thick green pus on January 1st, 1907, by Mr. Jones, F.R.C.S.E."

Present Illness.—Patient has never been in good health since his arrival at this station (Jersey, February 26th, 1907), but has managed to do his duty. About three days before his admission on July 21st, he thought he had strained himself by lifting a 100 lb. shell. On admission, patient complained of some abdominal pain, and referred it principally to the area of the stomach. There was constipation, a furred tongue, no headache, and very slight fever, 99·2° F. Some abdominal resistance was observed, which extended across the abdomen from the ninth rib on the right side in a straight line to 3 inches on the left side of the mid-line. With patient's previous history I suspected liver abscess, but there were no definite symptoms to call for operation. The pain increased very gradually, and by August 8th a well-marked tumour was to be observed in the area where the previous resistance had been noted.

After consultation with Lieutenant-Colonel Yourdi, R.A.M.C., I determined to operate, as the presence of pus was feared from the tempera-

ture of the previous days. I first tried to aspirate the liver in the ninth intercostal space, but could not find any pus. This small opening was closed with gauze and collodion. An incision was made in the mid-line, the centre of it being half-way between the umbilicus and ensiform cartilage. Inflammatory tissue was met with to the depth of over 1 inch, and necessitated enlarging the original incision to obtain working room. The tumour being isolated from the rest of the abdominal cavity by packing it around with gauze, I inserted a fine exploring needle and withdrew a small amount of thick, curdy pus. Using the exploring needle as a guide, I then passed an aspirating cannula down into the tumour and drew off 6 ounces of thick, green, curdy, blood-stained pus, obviously liver-abscess pus. A probe being introduced before the cannula was removed, a drainage tube was passed over it into the cavity and left *in situ*. The two ends of the incision were closed, and a cyanide gauze dressing applied. Patient was very weak, and did not take the anæsthetic well. Five hours after the operation patient's temperature had dropped to 98·6° F., and he only complained of a slight pain at the site of the wound.

By August 12th patient had rallied well, the temperature keeping normal and there being practically no pain. The drainage tube had been changed for gauze drainage on the 10th, and by August 18th patient was on chicken diet, and making very rapid progress towards convalescence.

He was discharged hospital to attend on August 31st (twenty-three days after the operation). He did light duty for a month and was finally discharged to ordinary duty on September 29th. This delay in sending him to ordinary duty was caused by my not wishing to strain the scar of the abdominal incision. One interesting complication occurred during convalescence. A large abscess occurred in the old scar of the operation for his second liver abscess, performed by Mr. Jones at Seaforth. This abscess soon cleared up on opening it and using boric fomentations. I may mention that the pus from it was not liver-abscess pus, and was probably due to buried stitches.

A CASE OF ATROPINE POISONING.

By Captain N. E. HARDING.
Royal Army Medical Corps.

The susceptibility to atropine in the following case was so well marked that perhaps it is worth recording. The patient, a man aged 42, had been suffering for some time from anomalous symptoms probably due to arterio-sclerosis, but it was thought well to examine his ocular fundus, and so at 11 a.m. on September 12th, 1907, two drops of the pharma-

copœial solution of atropine sulphate were placed in each eye. About five minutes later the patient observed that his pupils were beginning to dilate, but as no unpleasant symptoms supervened the dose was repeated at noon. About half an hour later dryness of the throat and a curious taste, which seemed to travel from the nose down the throat, were noticed. Almost immediately after this his head seemed to be going round, he was unable to urinate, palpitation was very marked, and he felt so hot, flushed and generally ill, that he wrote a note asking me to see him. When I arrived at 2.15 p.m. his face, neck, chest and fore-arms—the only parts seen—were bright red, almost scarlet. The throat was extremely dry and injected, and the pulse about 90, though it had been much faster, he was positive. The pupils were so widely dilated that he was quite unable to read, and he had not been able to eat anything at 1 p.m. when he had tried. The dryness of the throat was so extreme that he had had constantly to take small sips of soda water to relieve it. He was then feeling much better than he had been an hour and a half before, though still altogether unable to pass urine. At 5 p.m. he was well enough to drive a mile and have his eyes examined, when it was found that he had a moderate degree of hypermetropia of the left eye, and slight simple hypermetropic astigmatism of the right, the fundus being normal. He was still very flushed, and complained of dryness and a curious taste in the mouth, but with much difficulty succeeded in letting a little urine dribble away. By 8.30 p.m. he had improved enough to eat some dinner, and on going to bed took about a third of a grain of sulphate of morphia, but could not get to sleep.

On rising the following morning, September 13th, 1907, he could only dribble away urine until 7 a.m., when he passed a large quantity, which was examined, though not for atropine, and appeared to be normal. At 9 a.m., when seen by me, he was still distinctly flushed and could only see very distant objects at all, while his pulse ranged from 60 to 70. At 5 p.m. his throat was still dry and injected, but he could read capitals about $\frac{5}{16}$ inch long at 2 feet approximately.

Next morning, September 14th, 1907, he felt much better, but his astigmatism, which he had never before noticed, now came into play, so that at 3 feet he could only see the second hand of a watch distinctly at 9 and 3 and not at all at 12 and 6. At 1 p.m. he felt very bad; but I think his symptoms—fulness in the head and tightness across the chest, with tingling in the hands and feet, most marked on one side—were due to his disease and not to the drug, for he had often had them before, though not to the same degree; besides which, according to Mitchell Bruce,[1] the last trace of it ought to have been excreted more than twenty-four hours previously. That night he slept well as the

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[1] "Materia Medica," London, 1905.

result of 15 grains of trional, and the following morning, September 15th, 1907, though his pupils were still widely dilated, he could read small print at 2 feet and write a letter, but it was not till September 22nd, 1907, that his eyes completely recovered.

Remarks.—It will be observed that, though the systemic effect was so marked, less than a hour after the second dose he was still able to write a note in what appeared to me to be his ordinary hand. The atropine solution had been recently made up, and to show that it was not over strength, I may mention that a native had been given the same dose of it six times in the preceding twenty-six hours without producing any untoward symptoms, and, indeed, without fully dilating both pupils. It is difficult to estimate the actual amount absorbed, but as the conjunctival sac only holds about a drop, and the irritation caused by the atropine produces such a flow of tears that most of the remainder is rapidly washed away, I cannot believe that, at the very outside, it was more than $\frac{1}{100}$ of a grain in all. The patient suggested that possibly the overflow from his eye ran into his mouth, but if that had been the case I cannot help thinking he would have noticed it and spat it out; besides, even if he had absorbed the whole eight drops, he would only have had about $\frac{1}{28}$ of a grain at each dose, or about an ordinary dose.

Of the authorities I have been able to consult, Fuchs[1] states that atropine poisoning may occur from instillation owing to the solution running down the canaliculus, but in this case also I presume the patient would notice it; Hale White[2] and Mitchell Bruce (*op. cit.*) only refer to chronic poisoning as being caused in this way; Whitla,[3] Swanzy,[4] and Lyons,[5] do not mention it; Dixon Mann[6] speaks of it as having occurred not unfrequently, but does not say whether he is referring to acute or chronic poisoning; and the only actual cases I have been able to find are quoted by Collis Barry[7] from the *Lancet* of 1890, in one of which marked toxic symptoms were produced in a boy, aged 12, by eight two-drop instillations of a $\frac{1}{2}$ per cent. solution, while in the other, a man aged 73, was similarly affected by three such instillations.

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[1] "Text-book of Ophthalmology," New York, 1901.
[2] "Materia Medica," London, 1905.
[3] "Materia Medica."
[4] "Diseases of the Eye," London, 1907.
[5] "Medical Jurisprudence for India," Calcutta, 1904.
[6] "Forensic Medicine," London, 1893.
[7] "Legal Medicine," new edition, undated.

WHEN SHOULD MERCURY BE GIVEN FOR SYPHILIS?

By Lieutenant-Colonel W. W. PIKE, D.S.O.
Royal Army Medical Corps.

The answer usually given to the above heading is, "When you are sure of the disease."

This opens up a very large field for controversy. I think it is generally admitted that the earlier we give mercury the more readily does the disease become cured. I have for many years been in the habit of giving mercury to all patients on admission if the character of the sore was at all suspicious, and in a large number of these cases, though the sore looked a true hard chancre, no rash or other secondary symptoms occurred. (1) Was the disease true syphilis? (2) Was it aborted by the mercury? I am inclined to answer both questions in the affirmative. Then, again, the regulations come in, and I ask, Is this man to be placed on the syphilis register for a couple of years, with the usual loss of proficiency pay, &c., when he has no constitutional symptoms?

I agree with Thalmahn, p. 8, Epitome, *British Medical Journal*, July 13th, 1907, that the earlier we give mercury the better the results for our patients. He has injected perchloride of mercury under the sore in suspicious cases and generally used inunction as well. Of thirty-three cases treated by him half had calomel locally, and half injections of perchloride underneath the sore, while all had inunction. Seven cases were free from secondary symptoms for six months when he lost sight of them. Eight cases were seen from six to fifteen months after, and showed no symptoms, and *in all these the* Spirochæta pallida *was found* before treatment was started. Of the other cases, he states that where the rash appeared it was noticed early and was more limited than usual. He says that about 30 per cent. of his cases, treated as above on the appearance of the chancre, had not shown any secondary symptoms after six months, and in those cases where they did occur they were mild in character.

I am of opinion that we should most undoubtedly use mercury both locally and generally in these cases: but what are we to call the disease if no further symptoms occur?

WANTED: A DIAGNOSIS.

By Captain J. E. HODGSON.
Royal Army Medical Corps.

The following are particulars of a case which is under my care:—

C. W., a British officer, aged 40, was first seen on September 3rd last, at Ranikhet, India, when he was found to have some fever (evening temperature 100° F.), but no other symptoms except slight aching pains in the legs and some coryza.

Previous Medical History. — Patient has twenty-one years' service, the whole of which has been spent in tropical and sub-tropical climates (Mediterranean, Egypt, South Africa, India). During his service he has never been on the sick list until his present illness, and he has been quite healthy except on one occasion in Egypt, in 1893, when he suffered from severe cough for five months. There is no medical record of this illness, but he informs me that he was attended by a medical officer during the period, and was advised "on account of the condition of his left lung" to go to Australia. After six months in that country, on leave, he returned to duty, having been pronounced quite recovered. This opinion was confirmed after return to duty. Since then his health has been perfect. There is no history of dysentery. He had a mild attack of hill-diarrhœa a short time before the onset of the present illness.

Family History.—Satisfactory. No history of tubercle.

History of Present Illness.—He had had "a cold in the head" for some days before the fever began. Digestive, urinary, circulatory and nervous systems apparently normal, and continued so throughout the illness. *Pulmonary System:* Except for very slightly diminished resonance and prolonged expiration over upper portion of left lung at the back, nothing abnormal could be detected. These signs are probably the result of his illness in Egypt in 1893. There has been no cough. The pyrexia continued for twenty-six days. It was hectic in type, normal during the morning and day, and rising to between 99° and 101·6° F. at night. It was accompanied by occasional free perspiration during the night.

Major J. C. Morgan, R.A.M.C., took a great deal of trouble in examining blood specimens from this case, which I sent to him at Naini Tal. Smears taken at an early stage were negative to malaria and leucocytosis. At a later stage the agglutination reaction of the blood was tested with strains of typhoid, paratyphoid and Mediterranean fever organisms, also with absolutely negative results.

On the twenty-fifth day of the illness a second blood count showed an increase of mononuclear lymphocytes to 19 per cent., but no other pathological feature.

On the twenty-sixth day patient complained of sharp pain on movement in the right shoulder. The pain was referred to the upper fibres of the right trapezius muscle, and also along a line between the shoulder and surface area of gall-bladder. The pain was only elicited by movement and hyper-expansion of the chest. It was not produced by deep pressure over the hepatic region.

On the twenty-seventh day a needle was inserted into the liver, with negative result, and the pain practically disappeared on the second day after counter-irritation. It was probably rheumatic in origin. It did not recur except occasionally in the upper fibres of the right trapezius muscle, on movement.

The patient complained on the thirty-sixth day of the illness of a sharp pain for a few hours over the surface area of the gall-bladder; this yielded to a blister. There has been no enlargement of the liver or spleen, and no pain on deep pressure.

From the thirty-second day until the present date, *i.e.*, October 14th, 1907, the temperature has been normal, except for two very slight rises in the evening. He is much reduced — markedly so — from his illness, and excessively anæmic. There is no indication of the cause of the pyrexia beyond the mononuclear increase above described. This would appear to indicate malaria, or a cachectic condition referable possibly to tubercle or pus; but, except for the two temporary attacks of pain above noted, and occasional sweats at night, neither of which symptoms were in any degree severe, there are no concomitant signs of either. A remarkable feature of the case has been the absence of all such symptoms. The patient has been absolutely free from discomfort of any description beyond the two attacks of pain.

Treatment.—Dietetic. Large doses of quinine, intramuscularly and by the mouth; salicylates and diaphoretics. Purgatives as indicated. Latterly ammonium chloride and cholagogues, with nourishing diet, iron, arsenic, and tonics. He is being invalided to England.

I forward the case as an interesting one for diagnosis. It is one of a long-continued low type of fever, with practically no other symptom, objective or subjective, and negative, except for the mononuclear lymphocytosis, to all blood tests. Kala-azar was considered, but there is no splenic enlargement. Tubercle or pus suggest themselves on the result of the second blood count.

THE NEW REGULATION POCKET-CASE OF INSTRUMENTS.

In the November Army Orders, a new (1907 pattern) regulation case of pocket instruments is approved to replace the former pattern. The list of contents is given below. The instruments are contained in a polished metal case, about the size of a cigarette case, provided with a metal clip in each half, which effectually prevents rattling. The hypodermic syringe, Symes' knife and scalpel, as well as the other instruments in the case, are "all metal," and can be effectually sterilised. The case is smaller and thinner than the last model, and when complete weighs less than 9 ounces, about half the weight of the former pattern.

Contents of Regulation Case of Pocket Instruments (1907 *Pattern*). *Size*, $4\frac{7}{16}$ *inches by* $2\frac{5}{16}$ *inches by* $\frac{3}{4}$ *inch. Weight*, 9 *ounces.*

Forceps, dissection	Pair	1
,, Spencer Wells	,,	1
Knife, Symes' abscess, and scalpel, in metal handle	No.	1
Needle, aneurysm, and director combined	,,	1
Needles, suture, triangular-pointed, size 9 (four in packet)	Pkt.	1

Probe, silver, corkscrew and plain ends	No.	1
Scissors, blunt-pointed	Pair	1
Spud, eye, combined with spool of silk in case	No.	1
Syringe, hypodermic, metal, with two platino-iridium needles (one in handle) combined with needle-box, containing :— Needles, suture, triangular-pointed, sizes 12 to 14, No. 12	No.	1
Tablets, hypodermic, morphine hydrochlor., gr. $\frac{1}{6}$	Tube	1
,, ,, strychnine sulph., gr. $\frac{1}{100}$	,,	1
Thermometer, clinical, in bayonet-catch case	No.	1
Case, metal, plated, to contain above	,,	1

Echoes from the Past.

EXPERIENCES OF A MEDICAL OFFICER WITH THE NEW ZEALANDERS IN SOUTH AFRICA.

By Surgeon-Captain J. S. PURDY.
New Zealand Militia.

The first incident of importance in our contingent (the 6th New Zealand Mounted Rifles) from a medical point of view, was an epidemic of German measles soon after our disembarkation, which assumed such alarming proportions on our arrival at Pretoria as at one time to threaten the exclusion of our unit from General Plumer's Column on its march to Pietersburg. Although we had altogether forty-two cases of rubella, we had no case which ever developed a temperature above 103° F., and no case in which there were any serious complications. It was noticed that in most cases there was enlargement of the cervical, post-auricular, and occipital glands. Speaking generally, the rash appeared first on the face,

then spread very rapidly over the body. After thirty-six hours, on an average, the rash had disappeared. In this epidemic we were able to trace the inoculation period directly to the introduction of the disease at Sydney, New South Wales, where it was introduced to our contingent by Trooper B. We put down the average incubation period at eighteen days. All the cases were isolated, and suspects, those who had been quartered with different victims, were left together in camp at Pretoria. So effectually was this system carried out that, after we left Pretoria for the march to Pietersburg, we had only six cases of rubella.

It was noticed during the campaign that when any disease of an infectious character, such as measles, was prevalent, the Colonials were more prone to attack than the home troops. Probably a larger percentage of the latter were immune, having been subject to the disease in childhood. Perhaps the Australian may be less adaptable to a change of environment than the Englishman. During the Pietersburg operations the Colonials had a larger percentage of sick than the Regulars. On the Olifant's River our men suffered a good deal from malaria and a bastard form of enteric, classified officially as "simple continued fever." No less than 176 New Zealanders out of 560 passed through the hospitals during their first two months in South Africa. The Queenslanders were equally unfortunate, though they escaped the epidemic of German measles, the column having been cleared of all cases before the arrival of the later Australian contingents.

The operations in which General Plumer's Force took part towards the end of April, 1901, and in the following month, were for the most part in the Bushveldt to the north of the Pienaar's River. Owing to the horse sickness, many of the men were dismounted. After a week's hard "foot-slogging" some of the men evinced an anxiety to come into hospital. There were a few cases where men were admitted with a temperature of 103° F. or 104° F. one day, and after a night in hospital the thermometer registered normal. It was found that one or two of the "Weary Willies" and "Tired Tims" had resorted to eating cordite as a means of creating a temperature, and so bluffing the doctors. This means of raising the temperature was discovered, by the men noticing the effects of cordite fumes when lighting a pipe with a stick extracted from a cartridge. I believe that if I was not actually the first to trace this peculiar form of illness to eating cordite, at least I was the first to record the fact (*New Zealand Medical Journal*, March, 1902). It is now known that this prac-

tice of eating cordite became rather popular as a means of "going sick," especially later in the campaign. I may state, however, that I never saw any cases develop maniacal symptoms such as those recorded by Major J. W. Jennings, D.S.O., R.A.M.C., in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, October, 1903. Whilst resident at the London Lock Hospital, in 1903, I had an opportunity of cross-examining some reservists who had served in South Africa. These men said that cordite eating was fairly common, and that though some of the men may have done it in order to become "drunk," yet the majority did it in order to send the "glass" up.

Of course in every body of men there are "wasters," and after a few months these men either took the rough with the smooth or, from their importunate incorrigibility in "going sick," managed either to finish their service in a hospital, a rest camp or a remount depôt, or to get discharged. In all fairness to the New Zealanders, I may state that such cases were rare. However, I can say without hesitation that in my opinion not sufficient discretion was shown in the choice of the men for the later Colonial contingents.

With regard to the New Zealanders, physically they were the pick of the Colonials; but for that very reason many of the men were handicapped; being too heavy for the prolonged marches, the result was seen at the end of each trek by the number of dismounted men. With regard to the Queenslanders, I have seen many sent into hospital with the remark, "You should never have been sent out to this country." The great defect was the absence of teeth, or the want of sound ones. I actually saw one man who had been twice operated on for necrosis of the femur, and who had never been able to ride within three months of landing in South Africa. I mention this fact to show how many statistics which have been published of the incidence of disease among the troops in South Africa, especially among the Irregulars, are a little misleading, if it is assumed that all the men who landed in South Africa were physically fit for an arduous campaign.

My general impression after eighteen months' service was that, given a man fully grown, who escaped enteric, dysentery, or other such disease incidental to campaigning, on the whole the physique and health of the troops improved by residence in South Africa. A point worthy of mention was that the chest measurement of most of the men increased after six months' trekking on the high veldt. The minimum chest measurement for a trooper in the 6th New Zealand Mounted Rifles was 36 inches when expanded. The

average chest expansion of 120 men whom I passed for the contingent in Wellington, New Zealand, was 3½ inches. I did not have an opportunity of measuring the chest expansion at the end of the year's service, but in a dozen cases in which I did take measurements there was an increase of from ½ to 1½ inches.

My first actual experience of gunshot wounds was the case of a young Boer, shot at Warm Baths. Wounds of entrance and exit ⅓ inch to left of left femoral artery, 1 inch below Poupart's ligament, and 2 inches to left of third sacral vertebra. This case, after being treated with a field dressing, carried to the field hospital on a tonga (a light covered-in mule-cart for getting the wounded off the field) and then taken to Pretoria by hospital train, did well, recovering within three weeks. Here I may state that I never saw wounds heal so quickly as I did out on the high veldt. Where the element of sepsis was eliminated, it was the rule rather than the exception to get rapid healing by first intention. I have noticed, however, that men who received slight wounds at the commencement of one of our many long treks with General Plumer, did better than cases wounded towards the end of some of our long marches, especially after the men had been fatigued by many night marches, as in the "drives" towards the end of the campaign. It has been suggested that the fatigue consequent on the severe marching lowered the resisting power of the tissues. Might it not also be that towards the end of a long trek the clothing had become ragged, torn, and filthy? In our marches with a flying column, for instance, the men did not have a change of underclothing; consequently a bullet which perforated such clothing could hardly escape becoming septic. The next case I saw was that of Private A., West Australians, a Mauser bullet penetrating both lungs. Severe shock, with hæmoptysis. Died after three days. In this case I injected ⅓-grain morphia a few minutes after he was shot. Later in the campaign I came to realise a fact that Lieutenant-Colonel R. Porter, R.A.M.C. (General Plumer's S.M.O.), noticed after Elandslaagte and in Ladysmith: that for bullet wounds as a rule, and especially in abdominal cases, it is always safer never to give an initial dose of morphia of more than ⅙ grain. In the same engagement, that of De Berg Pass, after leaving Piet-Potgieter's Rust, Private T., West Australians, received a wound of the ankle; the bullet did not shatter the tibia, and the man did well. Another man, with a superficial wound of hand, was simply treated with adhesive plaster. At Pietersburg I saw a thumb the first phalanx of which was shattered by a Mauser

bullet. Amputation; did well. At Krokodile Kop a Kaffir was treated for a compound comminuted fracture of radius and ulna, which was in a septic state. The wound had been inflicted three weeks previously with an elephant gun. Lost sight of Kaffir after dressing wound. At Kamelpoort I saw a Boer with a self-inflicted Martini-Henry bullet wound in the thigh. A month after receipt of the injury, when we arrived, he refused to be moved to hospital. The leg was in a state of malignant œdema; temperature 103° F. Probably died. At Trichardsfontein, a New Zealander with a Mauser wound of the knee and stomach was brought in, one bullet having passed through both while trooper was kneeling. Died four hours after admission to field hospital, from shock and peritonitis. The same day I saw a man with a pom-pom shot through the small intestine; he lived twenty-four hours. At Mooifontein seven men were killed almost instantaneously; wounds of brain, lungs, and heart. Also, thirty-two of our men, chiefly infantry, were wounded more or less severely. One man was shot transversely through the head, bullet ploughing through left eyeball. Died, three days after removal of eye, from meningitis. Our Chaplain had compound fracture of the thigh from a ricochet; he recovered at Standerton. Three cases of abdominal wounds recovered without any surgical interference. These cases were taken forty miles on ox-waggons, these possibly being steadier than the regulation ambulance waggons.

It is rather an interesting fact that we never had a death from enteric with General Plumer's Column. As a matter of fact, this column was so constantly on trek that we were not exposed to those conditions of life in standing camps which were so fruitful a source of enteric. However, whilst the column was resting at Wakkerstroom, after the fight at Onverwacht (January 4th, 1902), we developed quite an epidemic of enteric. I was put in charge of a convoy of 140 cases, mostly enteric, which were taken into Charlestown. Though these cases were taken over sixty miles in ox-waggons, we did not have a single death. In my opinion, the old Boer ox-waggons drawn by oxen were much steadier than the regulation ambulance waggon, at least for the rough country through which we had to trek.

After the attack on General Plumer's convoy at Mooifontein, General Ben Viljoen sent in a man under a flag of truce to ask for a doctor. I went out together with Private Watkins, R.A.M.C., and attended to the wounded, remaining in the laager all night. I saw one case with a shrapnel wound of the stomach; no exit;

temperature 103 F.° Another with shrapnel wound penetrating descending colon. Another with shrapnel wound of right lung, and Lee-Metford bullet through humerus. Another with bullet wounds of femur and ankle. In the morning, before leaving, I saw three other wounded Boers; a boy, sixteen years old, with superficial wound of chest, the same bullet also perforating humerus; a man with bullet wound of stomach; and a man with bullet wound of knee. I informed Commandant Walter Mears, before returning to camp, that the men with abdominal wounds would probably die if moved. But the wounded asked to be taken on with their comrades, rather than fall into our hands.

At Elandsberg, whilst conveying 104 cases of sick and wounded, collected from Generals Plumer and Knox and Colonel Rimington's Columns, from Piet Retief to Newcastle, I treated an officer with a wound from a Mauser, the bullet having entered the upper inner condyle of the left tibia. The other three medical officers attached to the convoy all recommended a search for the bullet. But, as I was responsible and in charge, I did not think it justifiable. Three days later the bullet was located 2 inches above outer condyle of femur by the X-rays at Newcastle, after removal, the case did well. At Trekdeanpoort, two men were shot; one in the head, the other through the heart; death instantaneous. Two were wounded, one through calf, speedy recovery; the other a wound 4 inches long, travelling along wrist and thumb; thumb amputated.

Having had charge of different sick convoys from General Plumer's Column, I had opportunities of seeing many interesting cases through the courtesy of the Principal Medical Officers of the different receiving and base hospitals. What all seemed agreed upon was that, except in certain circumstances, abdominal wounds were best left alone. Cases are recorded of men being left on the field with wounds of the stomach, owing to an oversight or the exigencies of warfare. These men did better than those picked up shortly after they were wounded. In the summer of 1903, while attending the Royal Army Medical College, I met a captain who had been hit in the stomach, and insisted on lying where he was hit for thirty-six hours, without anything more than merely a sponge to moisten his lips. He was back with his column within a month. Whilst in the Wepener district we had two men dangerously wounded in the abdomen. One died within eight hours; the other, with some more wounded, was left over night under my care at a Boer farmhouse. After burying the first man, I received

orders to rejoin the column with the wounded. My second case died half an hour after reaching camp, twelve miles distant, though before moving he was doing well. Any man with a perforation through intra-peritoneal viscera has very little chance unless left in a temporary stationary hospital. As our work was generally at some distance from the different bases, we had rather a high death-rate among our abdominal wounded. Near Smitsdorp a man shot through the tibia made a rapid and good recovery. Whilst chasing six Boers near the Elandsberg, not far from Wepener, whilst out on patrol, I saw a corporal of the Mounted Infantry accidentally shoot himself with a revolver, the bullet passing from the centre of the frontal bone to just above the occiput. I noticed, as on some other occasions of brain-wounds, that the pulse remained fairly strong until the last. Ultimately this man developed Cheyne-Stokes' respiration, and died within three hours. At Mokari Drift, on the Caledon River, a Queensland officer was killed almost instantaneously by a bullet entering the centre of the coronal suture. At this engagement we had two nasty ricochet wounds, the bullets destroying larger masses of tissue than usual. A Boer was badly hit, a bullet entering at the level of the seventh cervical vertebra, 2 inches to left, and coming out at the level of the fourth rib. When I left him in charge of the Boer ambulance next morning, he was in a state of collapse. Another Boer had both radius and ulna broken by a bullet, but after I applied a first field dressing and a sling he rode away with the Commando (Louis Wessell's, under Kritzinger), when our guns began to shell the position. After this fight, where we had two officers and three men killed, I noticed what has often been pointed out, namely, the rapidity with which *rigor mortis* comes on after severe exercise. We had been riding hard for several hours before the fight at the drift; six hours after the men were shot their bodies were quite stiff. A New Zealand officer, shot a few days later, had a bullet wound penetrating thigh and leg without injury to the knee-joint, and made a rapid recovery. A Dutchman, of the Intelligence Department, was shot in the buttock at the Mokari Drift engagement. There was no wound of exit; probe entered 4 inches; X-rays applied; failed to locate bullet. Returned to column within a month and resumed duties. On January 4th, 1902, a New Zealander had a bullet pass through his left frontal sinus, and was doing well a month later, though I have since heard that the left eye had to be removed. A New Zealander had an acromial dislocation of humerus and suffered much pain after reduction.

Next day our column at Onverwacht lost twenty killed and thirty-six wounded. One officer with a perforation of bladder died within thirty-six hours. Another with a wound in the neck had paralysis of the cervical plexus, and afterwards developed general paralysis; died third morning. An Imperial Yeomanry trooper with a large wound, 3 inches in circumference, smashing eighth rib and exposing liver and lung, was living when I handed over the wounded to the medical officer in charge of the hospital at Wakkerstroom. An officer with bullet passing from behind, partly through mastoid, and coming out near left orbit, was doing well when transferred. He ultimately recovered, but was unfit for further service. At Vaal Bank Spruit on December 10th, 1901, there were ten Queenslanders wounded. One man was left on the field for dead by his comrades, but was picked up by Surgeon-Captain Hutchings and myself two hours later with a bullet through the brain; entrance ½ inch above left superciliary ridge; exit, blowing away 4 inches by ½ inch of the centre of the left parietal bone; brain substance to the amount of one teacupful removed at time and when dressed. Regained consciousness second morning for about twenty minutes, but died three days later. A Boer shot through the centre of the forehead, bullet coming out 2 inches above occiput, was living when I last heard of him five days later, though he had not regained consciousness. This patient had to be strapped down on the stretcher to prevent him from tearing off his dressings. At this engagement there were three wounds of hands—all very painful. Usually, when there was much pain, we gave morphia on the field, starting with ⅛ gr.

All the wounds were dressed on the field with first field dressings, gauze, wool pad, waterproof, and bandage. I preferred to apply first the gauze, then the pad, then bandage without applying the waterproof, which in the event of much serous discharge often aids decomposition. After removal to the field hospital the wounds were more carefully washed with 1 in 1,000 perchloride of mercury and dressed with cyanide gauze.

A very interesting case was that of a sergeant of the Hampshire Mounted Infantry whom I attended after Onverwacht. He was shot about an inch below the middle of the left clavicle, with wound of exit to the left of the fourth cervical vertebra. The bullet had pierced his bandolier. This man appeared to make a good recovery, but died three weeks later of tetanus at Charlestown. At the *post mortem* a piece of leather was found lodged about 2 inches deep in the wound.

With General Plumer's Column, when full strength, we had

2,000 men. We had two field hospitals, each with three ambulance waggons each, carrying two lying-down cases and one tonga.

Stretcher drill, as I was taught it whilst a member of a bearer corps, is practically useless on field service, though I suppose that the general discipline it inculcates counts for much. With Colonel Pulteney's Corps each unit had its own ambulance, but this did not prove a satisfactory arrangement.

The most common complaints were diarrhœa and dysentery. The usual treatment was to commence with 6 drachms castor oil and 6 minims tr. chloroformi et morphini comp., together with 1 ounce of brandy.

We had about half a dozen cows with each hospital, and, except when we were very full, were able to keep patients on fresh milk diet. When we could not get fresh milk we found the "Ideal" was best appreciated by the patient. We also used bovril and Lazenby's soup squares. Tinned chicken was generally resorted to in the field when the patient was improving.

A medical officer's billet with General Plumer's Column was no sinecure. Whilst in the Free State, Surgeon-Captain O'Neill (my colleague with the New Zealanders) and I, for three weeks, averaged five nights a weeks out on patrol. As it was often impossible to take wheeled transport, one was sometimes left on the veldt several hours with a wounded or disabled man. To be at it from 2 a.m. to 3.30 a.m. the following day, perhaps wet through, as we were on at least one occasion, and then only to get three hours' rest before trekking, seemed pretty rough; but we had a very good time on the whole compared to the men who, after a march of 30 miles by day, had to do outpost duty at night. However, in spite of the hardships of the life, those of us who were fortunate enough to miss any serious illness, for the most part improved in health. As evidence of the beneficial effect of an open-air life in South Africa, I may mention that my own weight increased from 10 st. to 11 st. 3 lb. during a year and nine months' residence in the country.

Reprint.

THE TREATMENT OF SCABIES.[1]

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

Prior to 1906, all cases of scabies in the Colchester garrison were treated by sulphur, or liq. calcis sulph. Since January, 1906, every case has been treated by balsam of Peru. The last twenty-four cases have had the application removed by a hot bath twenty-four hours afterwards. No case has relapsed, and no albumin has been found in the urine. It seems certain, therefore, that the acari and their eggs are destroyed within a few hours after the application of the balsam. The following table appears to show:—

(*a*) The diminished prevalence of itch in the garrison during the last two years, which may, I think, be justly ascribed to the perfection of the cure on the men's discharge from hospital, so that they are no longer liable to convey it to their comrades.

(*b*) The much reduced stay in hospital of each case, leading, of course, to a smaller loss to the State.

Year	Average strength of garrison	Number of admissions for scabies	Total number of days in hospital	Average number of days in hospital
1904	3,168	89	1,691	19
1905	3,252	82	955	11·64
1906	3,573	51	179	3·59
1907 (to Nov. 1)	3,349	43	121	2·81

If it were possible to disinfect the men's clothing at once, they need not have been taken into hospital at all. As it is not possible with the naked eye to accurately locate the parasite, I prefer to paint the whole body at the same time. I do not think your American military correspondent is ever likely to hear of a British soldier meeting the same fate as the French Cupid. Balsam of Peru is soluble in water, and a profuse perspiration would dissolve the application. It is, I think, a vastly different procedure from varnishing the whole body with copal varnish and applying gold leaf accurately to the surface.

Lieutenant-Colonel W. J. Baker, R.A.M.C., reports 61 cases treated in his hospital in Dublin[2] without a relapse or other untoward incident.

[1] Reprinted from the *British Medical Journal* of December 14th, 1907.
[2] *Journal of the Royal Army Medical Corps*, September, 1907.

See Page 645

Abstract.

PRELIMINARY REPORT ON THE HABITS, LIFE CYCLE AND BREEDING PLACES OF THE COMMON HOUSE FLY (*MUSCA DOMESTICA*, LIN.), AS OBSERVED IN THE CITY OF LIVERPOOL, WITH SUGGESTIONS AS TO THE BEST MEANS OF CHECKING ITS INCREASE.

By ROBERT NEWSTEAD, A.L.S., F.E.S., &c.

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This investigation has been conducted chiefly with the view of ascertaining the nature and extent of the breeding places of the common house fly (*Musca domestica*, Lin.), in the City of Liverpool, and also the period of the life cycle of the fly under varying atmospheric and other conditions, so that some practical measures might be devised for the destruction of this pest.

Nature and Extent of Survey.

Altogether, the refuse from over three hundred ashpits and bins (chiefly the former) was examined, and thirty-seven middensteads carefully inspected. Human excreta found in the courts and passages was also inspected, and breeding-cage experiments with this and the excreta of domesticated animals were also conducted. The result of the investigation and survey has proved eminently satisfactory, both from an economic and scientific standpoint. It has led to the discovery of the chief breeding places of the fly, and many new and interesting facts relating to the food of the larval stages have been brought to light, so that we are now in possession of the more important facts relating to the economy of this pest.

Permanent Breeding Places.

The chief breeding places of the house fly may be classified under the following heads:—(1) Middensteads containing horse manure only. (2) Middensteads containing spent hops. (3) Ashpits containing fermenting materials.

Leaving for the present the minor breeding places, we may proceed to consider the chief ones in detail.

(1) Stable middens containing horse manure only were, broadly speaking, found to be the chief breeding places. In the majority of these the larval stages of the house fly occurred in countless thousands, revelling in the heat produced by fermentation. The adjacent walls often swarmed with newly-hatched flies, and occasionally one also found

enormous masses of their eggs, while deep down at the sides, in the cooler portions of the receptacles, the pupa or chrysalis stage occurred in enormous numbers, looking like small heaps or collections of reddish berries. Middens containing a mixture of horse and cow dung were also infected, though to a less extent than those receptacles containing horse manure only. It is important to note, however, that in all cases where fowls (not ducks or geese) were kept and allowed freedom in the yards, relatively few of the earlier stages of the house fly were found, and whenever present were invariably located in places inaccessible to the fowls. To make certain that the fowls were responsible for so remarkable a diminution of the fly larvæ and pupæ, a trowel full of these was thrown to some fowls, when they were eaten with as much avidity as if they had been so many grains of wheat. However much, therefore, we may deprecate the keeping of fowls in large towns, we must, from the evidence which has been adduced, consider them as important contributory factors in the destruction of the earlier stages of the house fly. It should be pointed out, however, that fowls are kept in very few of the stable yards, so that in the majority of cases the flies go on breeding uninterruptedly, and, so far as one can gather, the larvæ and pupæ have few, if any, other natural enemies than those already mentioned.

In one case, where large quantities of a disinfectant (Sharrant's disinfectant powder) were used in a stable, no larvæ or pupæ were found in the manure, though they swarmed in a mass of waste hops in a separate division of the same midden. Fly larvæ were also absent in another instance where chloride of lime had been freely used. However, one is not prepared, at the present moment, to state definitely that the presence of either of these agents had any deleterious effect on the fly larvæ, or that they acted as a deterrent; it may have been a simple coincidence, and the matter requires further investigation. All types of middensteads were infested—*roofed*, *vaulted* and *open*.

(2) Only one midden containing warm spent hops was inspected, and this was found to be as badly infected as any of the stable middens. The pupæ were found collected together in large masses, and the larvæ swarmed in the warmer parts of the material.

(3) A great deal of time was given to the inspection of ashpits, and it was found that wherever fermentation had taken place, and artificial heat had been thus produced, such places were infested with house fly larvæ and pupæ, often to the same alarming extent as in stable manure. Such ashpits as these almost invariably contained large quantities of old bedding, or straw and paper, paper mixed with human excreta or old rags, manure from rabbits hutches, &c., or a mixture of all of these. About 25 per cent. of the ashpits examined were thus infected. House flies were also found breeding, in smaller numbers, in ashpits in which no heat had been engendered by fermentation. Both open and closed ashpits were infested, but on the whole the flies gave preference to the

closed receptacles. On opening the doors of some of the covered ashpits, the flies often came away in hundreds, appearing like bees round a hive. Ashpits which had been previously treated with disinfectants were also infested.

Effects of Temperature on the development.

Temperature has a most marked effect upon the developmental cycle of the fly; and a sudden check from heat to cold will materially prolong any one of the stages. Eggs hatched in eight to twelve hours in a temperature of from 75° to 80° F.; in a temperature of 60° F. in twelve hours; but in 45° F. they did not hatch until the third day, and then only when placed in a warmer temperature for the purpose of studying them under the microscope. The larvæ or maggots mature in the shortest period in fermenting materials in a temperature of between 90° and 98° F., but they usually leave the hotter portions of the stable manure when it reaches a temperature of 100° to 110°. In 54° F. both larval and pupal stages are considerably prolonged; larvæ kept at this temperature had not matured at the end of eight weeks, and a number of pupæ kept under similar conditions did not produce flies until the fourth and fifth weeks.

Summary.

In this report I have endeavoured to show that:—

(1) The chief breeding places of the house fly are: (*a*) Stable middens containing fermenting horse manure or a mixture of this and cow dung; (*b*) middens containing fermenting spent hops; and (*c*) ashpits containing fermenting vegetable matter, or about 25 per cent. of the total number of pits examined.

(2) That covered ashpits and middens were as badly infested as those which were open.

(3) That house flies breed in all temporary collections of fermenting matters.

(4) That house flies breed in relatively small numbers in ashpits where no fermentation takes place.

(5) That they do not breed in ashpits which are *emptied at short intervals*, or in *patent bins*.

(6) That the use of disinfectants in ashpits does not prevent flies breeding in such receptacles.

(7) That very dry or excessively wet ashes or moist cow dung[1] does not harbour them.

(8) That the presence of fowls (not ducks or geese) which had free access to the stable middens, reduced the number of larvæ and pupæ to a very marked extent.

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[1] In excessively hot summers cow dung may form a breeding place for the house fly. The admixture of a large quantity of bedding (straw or sawdust) would also render it suitable for breeding purposes.

(9) That the life cycle of the fly, in all kinds of fermenting materials, is reduced to the minimum period of ten to fourteen days; and that in the absence of such artificial heat the cycle may occupy a period of from three to five weeks or more, according to the temperature of the outside air.

(10) That house flies do not depend entirely upon excessively warm weather for breeding purposes, though in hot seasons they would breed much more rapidly in non-fermenting materials, and their numbers, under such conditions, would be greatly increased.

SUGGESTIONS.

If house flies are to be reduced to a minimum, I would submit the following suggestions for careful consideration:—

(1) Stable manure and spent hops should not be allowed to accumulate in the middensteads during the months of May to October inclusive, for *a period of more than seven days*.

(2) All middensteads should be thoroughly emptied and carefully swept at the period stated in (1). The present system of *partly emptying* such receptacles should in all cases be discontinued. The walls of middensteads should also be cemented over, or, failing this, the brickwork should be sound and well pointed.

(3) All ashpits should be emptied, during the summer months, at intervals of not more than ten days.

(4) The most strenuous efforts should be made to prevent children defæcating in the courts and passages, and parents should be compelled to remove such matter immediately; defæcation in stable middens should be strictly forbidden. The danger lies in the overwhelming attraction which such fæcal matter has for house flies, which later may come into direct contact with man or his foodstuffs. They may, as Veeder[1] puts it, "in a very few minutes . . . load themselves with dejecta from a typhoid or dysenteric patient, not as yet sick enough to be in hospital or under observation, and carry the poison so taken up, into the very midst of the food and water ready for use at the next meal. There is no long roundabout process involved."

(5) Ashpit refuse, which in any way tends to fermentation, such as bedding, straw, old rags, paper, waste vegetables, dirty bedding from the hutches of pet animals, &c., should, if possible, be disposed of by the tenants, preferably by incineration, or be placed in a separate receptacle so that no fermentation can take place. If such precautions were adopted by householders, relatively few house flies would breed in ashpits, and the present system of emptying such places at longer intervals than, say, four to six weeks, might be continued.

[1] M. A. Veeder, M.B. "Flies as Spreaders of Sickness in Camps," *Medical Record*, vol. liv. (1898), pp. 429-430.

(6) The application of Paris green[1] (poison) at the rate of 2 ozs. to one gallon of water to either stable manure or ashpit refuse, will destroy 90 per cent. of the larvæ. Possibly a smaller percentage of Paris green might be employed with equally good results. One per cent. of crude atoxyl in water kills 100 per cent. of fly larvæ. The application of either of these substances might, however, lead to serious complications, and it is very doubtful whether they could be employed with safety. Paris green, at the rate of 1 to 2 oz. to 20 gallons of water, is used largely as an insecticide for fruit pests. It does no harm to vegetation when applied in small quantities; but cattle might be tempted to eat the dirty straw in manure which had been treated with this substance, and the results might prove fatal if large quantities were eaten.

(7) The use of sun-blinds in all shops containing food which attracts flies would, in my opinion, largely reduce the number of flies in such places during hot weather. Small fruiterers' and confectioners' shops, as a rule, are not shaded by sun-blinds, and in their absence flies literally swarm on the articles exposed for sale.

(8) The screening of middensteads with fine wire gauze would undoubtedly prevent flies from gaining access to manure, &c., but it is very doubtful if this method would meet with any marked success. The gauze would rapidly oxidise, the framework supporting it would probably warp, and numbers of flies would be admitted whenever the receptacle was opened. Moreover, the erection of such a structure would prove a great inconvenience and a hindrance to the removal of the refuse. This, however, does not prejudice the possibility of erecting a good fly-proof screen in the future.

Reviews.

Reminiscences in the Life of Surgeon-Major George A. Hutton, late Rifle Brigade (the Prince Consort's Own), Honorary Organising Commissioner, St. John Ambulance Association. London: H. K. Lewis, 1907. Pp. 224 × xiii. Price 5s.

"*Forsan et hæc olim meminisse juvabit*" is a motto applicable only to the less happy periods of life, but, leaving out the first two words, the rest may well be said of reminiscences such as those of Surgeon-Major Hutton. Such reminiscences are not only a comfort to the man who went through the events he describes, but a help to those who come after him, and more especially to those brother officers of his who live under conditions of service so different from those described by the narrator. Surgeon-Major Hutton began his professional career by going

[1] The composition of this substance is a definite chemical compound of arsenic, copper and acetic acid.

through the cholera epidemic of 1853 in Newcastle, where he so distinguished himself by his zeal and energy that, in spite of his comparative youth, he was invited to assist the Government Inspector, Dr. Gavin, in advising the authorities at Dundee how to avoid a similar outbreak. Shortly after this, rumours of war in the Crimea led him to offer himself for a commission in the Army Medical Department, and he was accordingly gazetted Assistant-Surgeon on June 23, 1854. Fortune did not, however, favour the young officer, and his footsteps were directed, not to the seat of war, but to the Cape of Good Hope. Here he relieved the tedium of ordinary garrison life by assisting to originate a Literary and Medical Society, which did good work in encouraging the study of natural history and cognate sciences in that country. Officers of the Royal Army Medical Corps might well imitate this example more widely than they do at present. They all start with the great advantage over other officers, of a training in scientific technique and modes of thought, and their time at many foreign stations is far from over-full with professional work. On the whole, Surgeon-Major Hutton's life in the Service was uneventful. He missed the two great campaigns of his earlier years, viz., the Crimea and the Mutiny, and his nearest approach to serious war was the abortive expedition to Canada at the time of the "Slidell and Mason" affair. In Canada he spent but a few months, and was fortunate in being able to conclude his tour of service there with a trip to the seat of war on the Potomac. After a period of service at home he was sent to Demerara, where he arrived in time to experience the severe yellow fever epidemic of 1866, but the remainder of his tour of duty in the West Indies seems to have been uneventful. The rest of his service was spent in England; and he had the interesting experience of taking medical charge of the first field hospital actually sent on manœuvres in 1871. His report on the work done by this hospital is to be found in the Army Medical Department Report for 1872, and contains many hints which still possess considerable value in spite of lapse of years and changed conditions. Surgeon-Major Hutton's service terminated on the completion of twenty years on the active list, but, unlike that of so many others, his career may almost be said to have begun with his retirement. The work which Surgeon-Major Hutton did in connection with the St. John Ambulance Association is well known to all those who have had any experience of ambulance work in this country. In fact, it is hardly too much to say that a great part, if not the greatest part, of the success which has attended the ambulance movement in this country, is due to the labours of Surgeon-Major Hutton, carried out often in spite of the ill-health which necessitated his retirement from the Army, and has at last forced even this indomitable officer to finally retire from the service of his fellow-men. This brief and inadequate notice cannot better conclude than by a quotation from the interesting and eloquent preface that Dr. Lawton Roberts, himself a distinguished worker in the ambulance field, has contributed to Surgeon-Major Hutton's book:—"Through the career unfolded before us there runs a lesson to all young men, but especially to the youthful Army medical officer, to seize every opportunity in the intervals of professional work for making careful observations and notes of his surroundings and the events in progress, in whatever locality he may be placed and in any position which he may occupy. Knowledge thus gained and stored

cannot fail to be of inestimable service to him in the future, and may in all probability be of great value to one or other branch of science, or even of high service to his country."

C. H. M.

Proceedings of the Royal Society of Medicine. Vol. i., No. 1, November, 1907. London: Longmans, Green, and Co. Price 7s. 6d. net.

The first number of this periodical contains the Proceedings of the clinical, dermatological, electro-therapeutical, epidemiological, medical, neurological, obstetrical and gynæcological, odontological, pathological, surgical, therapeutical and pharmacological sections of the Society. The sections are arranged alphabetically, and, in order to facilitate the binding of separate annual volumes for each, are independently paged. The contents consist chiefly of records of cases under the various sections, but there are also a number of interesting Presidential Addresses by Sir Thomas Barlow, Dr. Radcliffe Crocker, Mr. M. W. Deane Butcher, Dr. A. Newsholme, Dr. S. J. Gee, Mr. J. H. Mummery, Mr. S. G. Shattock, and Dr. T. E. Burton Brown. A. I. F.

Wellcome Photographic Exposure Record and Diary.

The 1908 edition of this little diary and exposure record, of which we have received a copy, has been ready for some time past. We think those who wish to save plates and films, which would otherwise be wasted owing to errors in exposure, ought certainly to have a copy of this diary and record, containing as it does that ingenious little mechanical calculator for correctly estimating exposure, which requires only a single turn of a single scale. The price of this handy little work is 1s.; and there are three editions issued: (1) For the Northern Hemisphere; (2) the Southern Hemisphere; and (3) the United States.

Current Literature.

Atoxyl-amaurosis.—In the *Deutsche Medizinische Wochenschrift* for December 5th, 1907, Dr. Fehr, Ophthalmologist to the Virchow Hospital, Berlin, contributes an interesting article on this subject. He records two cases, which both occurred in his private practice within six months (March to September, 1905).

His first case was a woman of 64, who had never had any previous eye trouble, and had been remarkably healthy until September, 1904, when she developed severe pemphigus. She was treated with injections of a 20 per cent. solution of atoxyl in a dermatological hospital. The injections were continued daily, from the 7th to the 23rd September inclusive, and again for a month before patient consulted Dr. Fehr on alternate days. About 25 grammes of atoxyl were administered in all. In March, 1905, the patient first visited Dr. Fehr. She said that for some weeks she had noticed a shadow cutting off the upper part of her

field of vision, and she complained of indistinct definition. In appearance she was well nourished and the pemphigus had disappeared. Her spirits were markedly depressed, but she presented no general symptoms of atoxyl poisoning, such as giddiness, weakness of the limbs or loss of taste, smell, or hearing. Externally the eyes presented no signs of alteration, movement of the eyeballs was normal, and the pupils reacted both to light and accommodation. When the sight was tested

$$\text{V.} = \frac{\text{R.} + 1\,\text{D} = \frac{6}{12}}{\text{L.} + 1\,\text{D} = \frac{6}{9}} + 3{\cdot}5\ \text{D} = \text{Snellen, } 1\tfrac{1}{2} \text{ at 18 inches.}$$

The field of vision was contracted for both eyes, especially on the nasal side. The ophthalmoscope showed a uniformly pale disc with a somewhat indistinct margin, and much contracted retinal arteries. The retinal veins were normal.

The central nervous system, heart and kidneys, were sound, and no cause for the visual defect could be discovered, other than the administration of atoxyl. Treatment consisted in stoppage of the drug, purging, sweating, administration of iodipin, and inhalations of amyl nitrite. During the following weeks a slight improvement in visual acuity and field occurred; but a month later (in May, 1905) a relapse of the pemphigus occurred which required further injections of atoxyl. It was not till the end of June, 1905, that the drug could permanently be dispensed with. The condition has since remained practically stationary, as on September 28th, 1907, the following was observed :—

$$\text{V.} = \frac{\text{R.} + 1 = \frac{6}{12}}{\text{L.} + 1 = \frac{6}{12}}$$

while the field remained as it was two and a half years before.

Dr. Fehr's second case was very similar and came under his observation in September, 1905. This was a woman, aged 61, who had suffered from lichen ruber for three years, but was otherwise healthy. From January, 1903, to May, 1904, she had been treated with injections of atoxyl, Fowler's solution being given internally at the same time. The first course of injections was given in June and August, 1903. Injections were given twice or thrice a week, twelve in all, of a 20 per cent. solution. During this first course of injections, symptoms of general upset were produced; general malaise, severe pains in the chest and back, and loss of appetite. The Fowler's solution had never caused discomfort. The injections had accordingly to be stopped, but in April, 1904, they were resumed. They could only be made at considerable intervals on account of the early appearance of symptoms of atoxyl poisoning. During this second "cure," in the course of two to three months 50 grammes of a 20 per cent. solution of atoxyl at most were injected; *i.e.*, 10 grammes of atoxyl. The twelve injections given nine months previously, can be ignored as causative of the eye trouble which ensued in May, 1904. The first symptoms of the latter were shadows and flashes of light before the eyes, and photophobia. The latter, together with marked nervousness and great mental depression, continued to increase even after stoppage of the injections. On examination the eyes appeared normal, pupils reacted well, visual acuity :—

$$\text{V.} = \frac{\text{R.} + 2 = \frac{6}{9}}{\text{L.} + 2 = \frac{6}{9}} + 4{\cdot}5 = \text{Snellen, } 1\tfrac{1}{2} \text{ at 18 inches.}$$

The optic discs were quite pale, their margins not very distinct. The retinal arteries appeared very narrow. The field of vision was markedly and concentrically diminished, especially on the nasal side.

In this case also no cause other than atoxyl could be discovered for the defective vision. The same treatment was carried out as before. The result confirms the diagnosis of a toxic neuritis, as, after the lapse of almost two years, not only is there no increase of the symptoms, but with improvement of the general condition, a substantial increase of the field of vision has occurred. On July 25th, 1907, the condition was: pupil reaction normal; visual acuity:—

$$V. = \frac{R. + 2 = [illegible]}{L. + 2 = [illegible]}$$

Field of vision considerably enlarged. The ophthalmoscope shows a pale disc, with retinal arteries narrow and sclerosed from their point of escape from the disc margin. There was good ground for thinking that in this case also the patient would retain her vision.

Clinically the following points are to be noted:—

(1) Persistence of a normal pupil reaction.

(2) Good central vision with marked diminution of the field, especially on the nasal side.

(3) Uniform pallor of the whole optic disc, with narrowing of the retinal arteries.

(4) A comparatively satisfactory result.

As regards the pathology of atoxyl amaurosis, Dr. Fehr considers that it must differ from that of tobacco or alcohol amblyopia. In the two latter conditions there occurs a chronic interstitial neuritis of the papillo-macular bundle in the trunk of the optic nerve, with ascending and descending degeneration. In atoxyl poisoning, the ophthalmoscopic appearances indicate a similar inflammatory process, but the focus of origin and mode of extension of the lesion must be different; for in tobacco and alcohol amblyopia there is a central scotoma with normal marginal vision, no marked vascular changes, and pallor merely of the temporal half of the disc.

The amaurosis resulting from atoxyl resembles that caused by lead poisoning. In both there is a concentric diminution of the visual field, pallor of the whole optic disc and contraction of the retinal arteries. Arguing on this analogy, it is probable that a *post-mortem* microscopic examination would disclose marked interstitial optic neuritis, with sclerosis of the vessels of the optic nerve and retina. Apparently atoxyl exercises a direct toxic action throughout the whole thickness of the optic nerve, with secondary alteration of the vessels and resulting disorders of circulation. Lesser and Greef, in the *Deutsche Medizinische Wochenschrift*, No. 27, for 1907, record a case of well-marked retinal hæmorrhage after administration of atoxyl.

Dr. Fehr goes on to discuss the question as to which part of the atoxyl molecule (mono-sodium-phenyl-amido-ortho-arsenate) $C_6H_5NH\text{-}AsO(OH)ONa + 2H_2O$, is the true toxic agent. From the similar phenomena produced by poisoning with antifebrin, he considers it probable that the amblyopia is due not to the arsenious acid but to the phenylamin (anilin).

The minimum quantity of atoxyl required to cause disturbances of

vision was 27 grammes in three months in a case of Bornemann's, 50 grammes in seven months in a case of von Krüdener's. In Dr. Fehr's cases the amounts administered could be only approximately estimated at 20 to 25 grammes in six months in the first case, and 10 grammes in two or three months in the second. The largest single dose given by Bornemann was 0·4 gramme, by von Krüdener 0·16 gramme, and in Dr. Fehr's cases 0·2 gramme. These doses cannot be considered excessive when Salmon gives 1·0 gramme doses, Hallopeau 0·75-1 gramme, and Lassar, who began with 0·2 gramme, has now raised his single doses to 0·5 gramme. Lassar considers that it is not so much the size of the dose that is important, as whether it enters the system or not, "apparently depending upon the alkalinity of the blood."

Apparently atoxyl has a cumulative action, for it is only after repeated injections extending over a considerable time that eye symptoms appear, provided that single doses are kept below 1·0 gramme. General symptoms may be observed after a few injections only, but need not necessarily precede eye mischief. Such general symptoms are: headache, oppression, giddiness, weakness, pyrexia and vomiting, with tickling and dryness in the throat. The eyes should always be carefully observed during a course of atoxyl. A. I. F.

Instructions for Construction of Military Hospitals in France. (Circular No. 44 of the *Bureau du Matériel* of Directions du Génie et du Service de Santé.)—The circular is the logical consequence of a circular of May 30th, 1907, fixing the principles upon which barracks and regimental *infirmeries* should be constructed and organised. It is based on recommendations made by the *Commission superieure consultative d'hygiène et d'épidemiologie militaires* (which is a kind of mixed civil and military advisory board), and approved by the Director-General of Engineers and Director-General of Medical Services. The principle is adopted of making each hospital that is constructed better than the last one constructed; and, consequently, much latitude is introduced into the programme of details.

The most material change adopted is that of reducing the size of wards to groups of not more than six beds. The object of this is twofold: (1) To give patients the greater quiet of a small ward; (2) to carry out processes of cleaning and disinfection without having to close too many beds at a time, as would be the case with large wards.

The senior medical officer, as well as the quartermaster, is to have official quarters in the hospital; and existing hospitals are to be improved as regards provision for infectious diseases and operating rooms.

The instructions in detail are those for an Army Corps (or regional) hospital of 300 beds. They are given under the following heads: Site; area; general arrangements; floors, walls, windows and furniture; special arrangements; fever wards; wards for injuries; wards for infectious diseases; administration block; special services; barracks for hospital orderlies; cookhouse and steward's stores; shower baths; disinfection building; laundry; mortuary; building for mental cases and prisoners; other annexes; quarters of senior medical officer and quartermaster.

The site should be of wide extent, giving about 240 square yards to each patient, or nearly 15 acres for the whole hospital.

The general arrangement should be in ward pavilions and buildings for special services, namely, two pavilions for fever cases, two for injuries, and two for infectious diseases.

The administrative block should contain the quarters for the officers on duty, &c., and also barracks for the men on one of the floors.

In constructing floors, mosaic floorings ("xylolith," "porphyrolith") are preferred to parquets. Walls should be oil-painted or varnished, and faced for 1 metre from the floor with impermeable material, with rounded angles. The windows should reach to 2½ feet from the floor. The beds are to be of iron with spring mattresses; bed-head tables to be of metal with impermeable shelves and top; spittoons to be fixed to the wall at a convenient height; special spittoons for individual patients to be of the simplest character, such as the impermeable cardboard spittoons, which can be burnt along with the contents. Special bags, or metal boxes, are to receive foul linen and take it at once to the disinfection building. Objection is taken to lifts or shoots for foul linen, because of the difficulty of disinfecting the interior. Central steam heating is recommended; and also electric lighting. If gas is used, the wards must be lighted from outside, and special arrangements made to keep the burner under control. Latrines will be of the flush-out system; but all matter coming from the infectious diseases block will be sterilised by heat or chemicals before passing into the drains. The system of drainage will be such as to permit of its exposure readily for inspection or repair.

Pavilions will, as a rule, be placed to look east and west. Each will contain fifty to sixty beds, in wards of not more than six beds. The space between the beds will not be less than 4 feet 3 inches (1·50 metres). One quarter at least of the total number of beds will be in single-bed wards. The size of the wards will be in proportion of about 100 square feet per bed, and about 1,200 cubic feet per patient. There must be separate entrances to all wards, and the doors and some of the partitions glazed at a height of 4 feet 3 inches from the floor, for purposes of supervision. A glass corridor along one side of the pavilion, on which all the wards open, is recommended; the glass panels of the corridor to be capable of being removed or opened as weather permits.

The fever pavilions are recommended to be constructed with the annexes in the centre. These should contain a dining room, a day room, a reading and writing room, a ward scullery, bath and ablution room, waiting room, w.c.s, and hospital orderly's room. In addition, there will be rooms in the basement for dressing material, antiseptic solutions, ward-master, medical officer in charge of the wards, and for dressing cases.

The surgical pavilion will have similar arrangements, but one of them will be for venereal patients. The first pavilion will have, in addition, an operating room for aseptic cases and one for septic cases, separate from one another. In each operating section there will be a room for operations, one for instruments and apparatus, one for anæsthesia and dressings, a laboratory and a room for the surgeon's cloaks, &c. Special arrangements for heating the operation room will be required, when the central heating is not working.

The pavilion for infectious diseases is to be divided into four separate parts, each approached by its own staircase; and provided with all the necessary accessories. Cases of enteric fever and of pulmonary phthisis will be treated in one or other of the sections of this pavilion.

The administrative block, besides containing all the necessary administration offices and stores, will have, on one side of the first floor, wards for officers, and on the other a ward for N.C.O.'s. The officers' wards will consist of four rooms, with all the necessary accessory rooms, and a separate staircase. Those for the N.C.O.'s will contain wards for not more than five beds each, and five single-room wards, with all necessary accessory rooms.

A building will be constructed for such special services as bacteriology, radiotherapy, electrotherapy, ophthalmology, dentistry, and mechanical therapeutics; with a room for medical officers, a waiting room for patients, ablution room, and water closets. It will be connected with the ward pavilion by a covered corridor.

In quartering the hospital orderlies, space will be allowed for one hospital orderly for every five beds. The barracks will have dining, recreation and reading rooms, medical inspection room, room for sick in barracks, dining and recreation room for N.C.O.'s, two prisoners' cells, and all the usual accessories.

The recommendations for the kitchen building are of the usual character, but hot-plate waggons are to be used for carrying the food to the wards, and only potable water is to be laid on.

In connection with each pavilion there is to be a special building for baths, to contain four rooms for simple or medicated baths, two for sulphur baths, one for vapour baths, one for therapeutic douche baths, two dressing rooms (one for officers), two bath rooms for orderlies and convalescents, a linen cupboard, a drying room, and a room for the orderly on duty.

The disinfecting building will be of the usual type, with separate receiving and delivering rooms; but it will have an incinerator for refuse and dressings, and a room for disinfecting the receptacles in which linen and other material are brought to the disinfector. The laundry will be near the disinfecting building.

The mortuary will consist of a mortuary, with storeroom for coffins, and office of the man in charge; a *post-mortem* room, with water laid on, and means of disinfecting all discharges from it before they enter the drains; and a room for pathological specimens, with dressing room and ablution room.

The pavilion for mental cases and prisoners will have the usual ward accessories. For mental cases there will be two ordinary and one padded ward. The prisoners' wards will consist of four single-bed wards.

Other outbuildings will be placed along the enclosing wall. These will consist of carpenter's, painter's, locksmith's, and tinsmith's shops; stables, ambulance-waggon sheds, and sheds and rooms for instruction of hospital orderlies in field medical units; ice-house; fire engine station. At the entrance gate there will be a lodge and quarters for the gate-keeper.

The quarters of the senior medical officer and quartermaster will be in separate pavilions and in telephonic communication with the various pavilions and special buildings.

The hospital, as a whole, will be in telephonic communication with the various barracks by the local telephone exchange.

W. G. M.

The Transference of Filariæ by Mosquitoes.—In the *Archiv für Schiffs- und Tropen-Hygiene*, Band xi., 1907, Professor Fülleborn, of Hamburg, gives an account of some interesting observations on the manner in which filariæ are extruded from the mouth organs of the mosquito, and subsequently enter the tissues of their new host. The three chief theories on the former subject are those of:—

(1) Grassi and Noé, who considered that at the moment of suction, the thin inner wall of the mosquito's labium ruptured at the point of flexion, owing to the pressure of the contained filariæ; and that the latter escaped and entered the skin between the stillettes.

(2) Annett and Dutton, who believed that the filariæ emerged at the point of junction of the labium and labella, where there is a thin membrane (Dutton's membrane), which is tightly stretched by the separation of the labella, and easily ruptured.

(3) Sambon, who asserted that the filariæ entered the œsophagus of the mosquito, and subsequently penetrated the skin during the act of suction.

In order to ascertain the exact method of infection, Professor Fülleborn inserts a thin disc of cork beneath the shaved skin of a rabbit's back, and fixes the cork in position by needles. He then places an infected mosquito in a 2 cm. wide glass tube, provided with a piston at one end. The open lower end of the glass tube is placed over the portion of skin raised on the cork. By depressing the piston the mosquito is speedily induced to bite. As soon as the act of suction begins, the mosquito is stunned by means of a spark from a powerful induction coil, one electrode being shaped like a small fork and placed softly across the thorax of the insect to prevent the proboscis being drawn out of the skin by a sudden straightening of the legs. In order to prevent the recovery of the mosquito and to keep the escaped filariæ *in situ*, a glass containing ether vapour is kept ready and placed over the creature. After a few moments the ether glass is removed, and, by means of a capillary tube, a drop of dilute rubber solution is run on to the surface of the skin around the mosquito. By this means the feet and proboscis of the insect, as well as any escaped filariæ, are fixed immovably to the skin. Next, the piece of skin to which the mosquito is attached is cut out, the underlying cork serving as a basis, and the whole immersed in 70 per cent. alcohol and then embedded in celloidin in the ordinary way.

By this means Professor Fülleborn was able to observe the filariæ in the act of emerging from the end of the labium on to the surface of the skin. If the latter be dry the parasites remain curled up close to the point of the labium, but on moist skin they move away for a distance of a millimetre or more.

As regards the penetration of the skin by the filariæ, Professor Fülleborn says: "The filariæ cannot enter the tissues between the stillettes, as these form a compact bundle which completely plugs the wound made by the mosquito; it is, however, possible that a few parasites may enter by the wound after withdrawal of the insect's proboscis. But the filariæ can evidently penetrate the unbroken skin directly, as I found them in the deeper layers of the latter when they had been merely placed on the surface of the skin, and when no mosquito-puncture was present. It is, to be sure, not always possible to demonstrate filariæ in the skin after the bite of an infected mosquito, and many of the former die if the skin is not moist, for filariæ larvæ resist drought only for a

short time. Temperature and moisture must therefore play a considerable part in the occurrence of infection. The parasites require a fair length of time to penetrate the skin, for I only found them in the latter when some time had elapsed between the act of biting and the fixing of the preparation. It may be objected that infection may also occur by ingestion, as, for instance, when dogs lick their mosquito bites, or swallow the insects whole. But this is rendered improbable by the fact which I have established, that mature filariæ larvæ live for a much shorter time in water than in blood plasma, which latter appears to be their natural element; while in the gastric juice of dogs they perish even more rapidly than in water." A. I. F.

Mosquito Larvæ and Fish.—In the United States Consular reports for November last, it is stated that *Pseudo-mugil signifer*, the "blue eye" fish of Australia, is found to subsist on mosquito larvæ. The Italian Government has taken up this discovery, and has asked that some thousands of the fish be sent to Italy, in order to place them in the swamps and marshes. A sufficient number has been successfully shipped from Australia to Naples, and the experiment is being watched with much interest. The fish is 1½ to 2 in. long, and is frequently found in the ocean and rivers of temperate and tropical zones. It thrives in shallow water. W. G. M.

Correspondence.

INOCULATION WITH YERSIN'S PLAGUE SERUM—A PERSONAL EXPERIENCE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In the Journal of November, 1907, p. 504, I see a note signed "N. M." relating to an unhappy experience of inoculation with Yersin's plague serum. As my experience of this remedy has been fairly extensive and somewhat different, it may be of interest.

I served in Mauritius from 1899 to 1903, during which time Yersin's serum was much used, both as a prophylactic and curative measure, and I cannot remember a single case in which such results supervened. I was inoculated at the same time as several other officers, to encourage the men of the 27th Madras Infantry to be done, as plague was prevalent at the time. None of the officers complained of the after-effects, and we all went to our work immediately after the operation. Personally I thought no more about it till the eighth day, on which I had an attack of urticaria on the arm in which the injection was made; after this I experienced no further inconvenience.

I have injected this serum intravenously frequently as a curative measure, and seen it done by others, and have never known of any bad

results. In the case of a European boy, aged 6, as much as 210 cc. was required before reaction set in, and he recovered rapidly. In my experience, if cases were seen early in the disease and freely injected intravenously, recovery was fairly certain; but advanced cases and pneumonic plague did not react. I may mention that Haffkine's serum was also used as a prophylactic, as it was said to protect for a much longer period; but the effects were said to be very severe in many cases, and it was difficult to persuade people to be injected. However, of about 800 men of the British Central African Rifles who were injected, not more than six appeared to suffer, and those not severely.

If "N. M.," or any other medical officer in Mauritius, will enquire from Dr. Rouget, Superintendent, Civil Hospital, Port Louis, I am sure he will obtain much useful and reliable information on this subject.

I am, &c.,
B. T. McCreery,
Lieutenant-Colonel, R.A.M.C.

Shahjahanpur, U.P., India,
November 28th, 1907.

FLEET-SURGEON BASSETT SMITH AND MALTA FEVER.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—The January number of the Journal has just reached Malta, and Fleet-Surgeon P. W. Bassett Smith's communication has been read with much interest. The statement on p. 6, however, requires contradiction, *i.e.*, "The great reduction of 90 per cent. cases among the military since milk has been more or less efficiently sterilised."

The use of goats' milk in any form ceased on May 21st, 1906, in hospitals, and, after July, practically in barracks, unless procured surreptitiously. No Mediterranean fever was contracted in hospital after June of that year; in the first six months of that year ten cases were admitted for other diseases and afterwards changed to Mediterranean fever. These may or may not have been contracted in hospital.

During 1906 there were 161 admissions to hospital for Mediterranean fever, of which nineteen were distinct relapses. The total average strength of the garrison during this period was 6,661, giving a percentage of admissions to strength for Mediterranean fever of 2·13, and of relapses of 0·29.

The admissions for the fever in 1907 were eleven. Of these, two were relapses of cases admitted in the previous year; one invalided to England early in 1906, who returned to Malta on December 10th, 1906, and in the following January had slight fever with pains, his blood on being tested giving the reaction for Mediterranean fever; the other was discharged

hospital in December, 1906, his urine being free from *Micrococcus melitensis;* he was, however, readmitted for relapse and finally invalided. Of the other cases eight are distinctly traceable to the use of goats' milk outside barracks, either with soda water, a concoction of egg-flip, or tea. The remaining case never drank milk in any form, but frequently drank water from a half-barrel where goats quenched their thirst at all periods of the day. He was admitted to hospital for abrasions caused by falls on ground soiled by goats' excreta, where he played football, and close to the water barrel. The percentage of admissions to strength amongst the troops for the year 1907 is only 0·19. Other cases occurring amongst the officers, their wives, and the women and children, have been traced to the use of goats' milk unboiled, either knowingly or unwittingly. The numbers of these cases are as follows: Officers, 2; officers' wives, 2; women, 3; children, 1.

As regards the discussion, we are unanimously of opinion that the goat is the sole cause of Mediterranean fever, through its secretions or excretions, directly or indirectly. The mosquito is rather a red-herring drawn across the scent.

I am, &c.,

Malta,
January 11*th*, 1908.

J. G. MacNeece,
Colonel, P.M.O., Malta.

MALTA FEVER.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Dear Sir,—I notice in the Journal of November last, a letter on this subject from Major M. P. Holt, D.S.O., asking for the publication of particulars of a certain case. As the case occurred in my hospital I am glad to let you have them. They are as follows:—

Sister X. left England by the P. and O. s.s. "Nubia" on March 30th, 1907. The ship touched at Malta on April 8th, 1907. The sister, with others, went ashore from 9 a.m. till 10.45 a.m., and visited other sisters at Valletta Hospital. She states that she has some sort of idea that there was fresh milk for tea that afternoon, but is quite uncertain about it. She arrived at Port Said on April 11th, 1907, about 8 p.m., dined on board, and went ashore with two other sisters, also for Egypt. They had some coffee at a café on the Boulevard, and stopped at the Continental Hotel all night. Sister X. reached Alexandria next day, April 12th, 1907. She "reported sick" on April 29th, 1907, and stated that she had been feeling more or less unwell since soon after her arrival. On 29th her temperature was 101·2° F. The leading features were headache and constipation. From this time she was confined

to bed, and had irregular fever with slight exacerbations for about six weeks. The range of temperature was low, the maximum point being 104° F., which was soon reached. The symptoms were practically limited to the abdomen throughout. They were, pains over the site of the hepatic flexure of the colon, and also over the sigmoid; the passage (after enemata, &c.) of masses of hard scybalæ and considerable quantities of mucus. Her exacerbations of temperature always coincided with the passage of these masses. There was some splenic enlargement. The blood reaction by Widal's method was negative to enteric fever on May 18th, 1907. It was positive to Malta fever on May 21st, 1907 (dilution 1—50). Pains in the bones, or joints, or elsewhere, were conspicuous by their complete absence. There was no rash. Towards convalescence there were profuse and rather exhausting night sweats on three or four occasions. The sister was invalided to England on July 31st, 1907. She returned to duty on November 15th, 1907, in perfect health. She states that she had no symptoms whatever while away. The serum reaction to a culture of *Micrococcus melitensis* is now (December 1st) negative in dilutions 1—25, 1—50, and 1—75.

From the above history it will be observed that, taking this to have been an undoubted case of true Malta fever, it might have been acquired in any one of four ways, viz.: (1) From infection ashore at Malta; (2) from infected milk, or provisions, taken on board the "Nubia"; (3) at Port Said, where the disease is known to occur frequently; (4) at Alexandria, where it has also occurred.

With regard to (2), the local P. and O. agent assures me that it is extremely unlikely that any milk was taken aboard at Malta, as the ships of this Company always carry frozen milk. As, however, the "Nubia" left Port Said after landing Sister X. there, and was, I understand, bearing up for Yokahama about the time she was ill, it is perhaps, obvious that further enquiries in that direction would have been fruitless. Now, if this case had been landed direct at Alexandria with true Malta fever, contracted as the result of a two hours' walk ashore at Malta, as suggested, other sources of infection being excluded, it would have been no doubt of very great interest. Unfortunately, however, the facts, as disclosed by the above history, are very different. They cannot, I think, be held to prove anything in particular, or to add to what is already known of the etiology of the disease. May I also remark that had it been otherwise the case would have been sent to the Journal for publication long before now.

I am, &c.,

Alexandria,
December 20th, 1907.

J. Barnett Wilson,
Lieutenant-Colonel, R.A.M.C.

REGISTRATION OF LANGUAGE PROFICIENCY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—I venture to express my opinion that there must be more officers of the Corps who can speak and read modern languages than have as yet recorded the fact at Headquarters. Possibly if an officer is not an "Interpreter," or "Passed," he modestly fails to record his language proficiency; nevertheless, many must have a good knowledge of colloquial French, German, Italian or Spanish, or sufficient acquaintance with them, or other languages, to enable them to translate into English articles from foreign medical journals.

At a time when original scientific research is being carried out by all Continental nations, it behoves all who have linguistic attainments sufficient to enable them to translate and possibly also to correspond in European languages, to place such attainments at the disposal of the Corps. Putting aside patriotism and *esprit de corps* as the sole motives, there are undoubtedly many openings for officers of the Corps with a knowledge of languages, both pleasant and of deep interest; whilst an ambitious man of ordinary ability will find himself brought into contact with men of high scientific attainments, to the distinct advantage of himself in every way.

I would, therefore, urge all officers of the Corps, and especially those who have their career still before them, to enter their qualifications in modern European languages in their confidential reports; and if there should be any who are allowing their attainments to lapse, it is to be hoped that they may now be encouraged to renew their acquaintance with such languages, and then not to hide their light under a bushel.

I know of one officer at least who is well able to "pass" in French, and with a little application, probably to be registered as an "Interpreter." I am sure there must be many others like him; hence this appeal for the mutual benefit of the Corps, the country and the officers themselves.

I am, &c.,

January, 1908. J. R. W.

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Original Communications.

REPORT ON THE GOATS ILL WITH MEDITERRANEAN FEVER BOUGHT IN APRIL, 1906, AND ON THE KIDS BORN OF SOME OF THEM AT THE LAZARETTO.

BY DR. T. ZAMMIT.

Public Health Department, Malta.
Member of the late Commission on Mediterranean Fever.

THE goats ill with Mediterranean fever, bought by the Commission on Mediterranean Fever in April, 1906, were kept for nearly a year at the Lazaretto with the view mainly to observe whether they would get better, or whether they would in time shake off the fever altogether. Later on I thought that it would be worth while to have these goats impregnated again, with a view to observe whether kids born from infected mothers would have acquired immunity against Mediterranean fever. The results of these observations are here tabulated.

For the sake of comparison, five kids were bought born outside the Lazaretto, of presumably healthy mothers, and of the same age as the kids born of our infected goats. Of the eleven animals, four, including the sheep, remained barren, but of these two continued to yield milk, which was tested, to the last; the other two dried up by September. Table A, on page 220, shows the result of the observations made on these animals :—

The sheep (No. 107), which had always proved to be badly infected, remained saturated with *Micrococcus melitensis* to the last.

TABLE A.

Showing State of Goats from September, 1906, to August, 1907.

Goat	September			October			November			December			January			February		
	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.
101	−	+	−	−	+	−	−	+	−	−	+	dry	..	+	dry	+	+	..
104	−	±	dry	..	±	dry	..	−	dry	..	−	dry	..	−	dry	..	−	..
107	+	+	6,000	+	+	300	+	+	5	+	+	150	..	+	dry	..	+	..
108	+	+	500	+	+	20	+	+	20	+	+	dry	..	+	dry	±	+	−
110	−	+	−	−	+	−	−	+	−	−	+	dry	..	+	dry	+	+	−
111	+	+	40	+	+	−	+	+	−	..	+	dry	..	+	dry	+	+	36
112	±	±	..	±	±	..	−	±	dry	−	−	dry	..	−	dry	±	−	−
113	+	+	..	+	+	−	+	+	dry	..	+	dry	..	+	dry	+	+	−
114	+	+	500	+	+	10	+	+	50	+	+	−	..	+	dry	..	+	..
115	..	+	dry	..	+	dry	..	+	dry	−	+	dry	Died ..	..	..	..	..	..
117	+	+	200	+	+	700	+	+	300	+	+	300	..	+	dry	..	+	..

Goat	March			April			May			June			July			August			Remarks
	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	Milk	Blood	Colonies per 1 c.c.	
101	+	+	..	+	+	15	±	+	−	±	+	−	±	+	−	±	+	−	Dropped 1 kid, Feb. 15. Killed Aug. 29.
104	..	−	..	..	−	..	..	−	..	..	−	..	..	−	..	..	−	..	Killed Aug. 8.
107	..	+	..	.	+	..	..	+	..	..	+	..	..	+	..	..	+	..	,, ,,
108	±	+	−	+	+	−	±	+	−	+	+	..	+	±	..	+	±	..	Dropped 2 kids, Mar. 27. Killed Aug. 29.
110	+	+	−	+	+	46	±	+	40	±	+	200	±	+	−	±	+	−	Dropped 2 kids, Feb. 10. Killed Aug. 16.
111	+	+	50	+	+	50	+	+	−	+	+	1,000	+	+	−	+	+	−	Dropped 1 kid, Feb. 6. Killed Aug. 29.
112	−	−	50	−	±	−	−	−	−	−	−	−	−	−	−	−	−	−	Dropped 2 kids, Feb. 11. Killed Aug. 29.
113	+	+	−	+	+	−	+	+	−	+	+	200	+	+	−	+	+	−	Dropped 4 kids, Mar. 31. Killed Aug. 29.
114	Died ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Dropped 3 kids, Mar. 8. Died Mar. 10.
115	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Died Jan. 26.
117	..	+	..	..	+	..	..	+	..	..	+	−	..	+	..	..	..	..	Killed Aug. 8.

M. melitensis recovered at *post-mortem* from 107, 111, and 117.

\+ Positive reaction.
− Negative reaction.

Its milk yielded throughout a large number of cocci, and at the *post-mortem* examination *M. melitensis* was abundantly obtained from practically all organs (spleen, liver, inguinal and mesenteric glands). This sheep therefore, found infected in April, 1906, never got better up to August, 1907, when it was slaughtered, a period of sixteen months, without, of course, taking into account the unknown period for which it was ill before it was examined. The animal during all this time showed no objective signs of disease; it never lost flesh, it fed well, and gave abundant milk, which looked normal till it became watery and then disappeared in January, 1907. At the *post-mortem* examination the animal looked normal and very fat, the veterinary surgeon declaring it a first-rate sheep, although he knew that it had yielded *M. melitensis* freely in its milk for months. A few sublumbar glands were found congested, even hæmorrhagic in parts, though not much enlarged. All the other glands looked normal but enlarged.

The same can be said of the goat No. 117. This animal kept lively and well all through, and gave a first-rate carcase, though *M. melitensis* was discovered in great abundance in all glands (inguinal, mesenteric and mammary.)

The goat No. 115 died in January, 1907, and as putrefaction had set in when it was brought over to the Lazaretto no *post mortem* was possible. It had been ill for some time and had ceased to lactate.

The goat No. 104 had dried up at an early date, and had remained barren. No *M. melitensis* had been obtained from its milk before it dried up, and its blood had ceased to react. At the *post-mortem* examination it looked quite normal, and no *M. melitensis* was obtained from any of the organs examined. To all intents and purposes the goat appeared cured of its attack of Mediterranean fever.

The rest of the goats had a regular pregnancy, and dropped from one to four kids in due time. One of them (No. 114) died of septicæmia after dropping three kids. The goats suckled their kids and kept quite well; their blood and their milk reacted more or less all the time, except for No. 112, which persistently gave no reaction, although *M. melitensis* was recovered from its milk twice in March (100 and 50 colonies per 0·1 cc.) and once in May (39 colonies per 0·1 cc.).

At the slaughtering of these goats sixteen months after their being discovered to be infected and six months after delivery, the infection had greatly subsided. Nos. 101 and 102 yielded no

M. melitensis at the *post-mortem* examination, though No. 101 had *M. melitensis* in the milk in April (15 colonies), and its blood had shown throughout a positive reaction. No. 110 also gave negative results at the *post mortem*, but its blood showed a strong reaction, and colonies of *M. melitensis* were abundant in its milk not earlier than May and June (69 and 300 colonies). No. 113 was the most curious of the series. Its milk and blood had persistently reacted throughout, and for about two weeks in June (two months before the *post mortem*), had yielded as much as 200 colonies per 0·1 cc. of milk, yet no *M. melitensis* could be recovered from any of its organs. The only goat that showed *M. melitensis* at the *post mortem* was No. 111, and that in a very unexpected manner. The animal had given positive reaction both in its milk and in its blood during life, and had excreted *M. melitensis* in its milk since February, 1906. No *M. melitensis* was recovered from the milk from April to June 12th, but up to June 22nd the colonies were very numerous, over 1,000 per 0·1 cc. At the *post mortem M. melitensis* was obtained only from the inguinal glands.

From these observations I think it is fair to conclude that goats once infected with Mediterranean fever very rarely if ever shake it off, and also that infected goats are a constant danger, as they are apt to yield infected milk unexpectedly. Another very interesting observation is that, although as a rule an infected milk reacts when tested like blood serum for agglutination with *M. melitensis*, cases were observed in which a milk full of micrococci failed to give the agglutination reaction. One feels also bound to remark that of the eleven goats examined Nos. 107, 111, and 117 only gave colonies of *M. melitensis* at the *post mortem*, and of these Nos. 111 and 117 had been treated by injection of dead colonies of *M. melitensis* about a year previously. The goats thus treated were Nos. 104, 111, 114 and 117.

REPORT ON THE OBSERVATIONS MADE ON KIDS FED ON INFECTED MILK.

Seven infected goats dropped kids at the Lazaretto in February and March, 1907.

Goat	No.	101	dropped	1 kid	
,,	,,	108	,,	2 kids	
,,	,,	110	,,	2 ,,	
,,	,,	111	,,	1 kid	
,,	,,	112	,,	2 kids	
,,	,,	113	,,	4 ,,	
,,	,,	114	,,	3 ,,	(one died *in utero*)

TABLE B.

SHOWING BLOOD REACTION OF KIDS FED ON INFECTED MILK.

	When born	February 20	February 26	March 4	April 16	June 20	July 26	August 2	August 12	August 17	August 24	September 2	September 9	September 17	September 23	October 1	October 3	October 10	Remarks
101	Feb. 15, 1907 ..	$+\frac{1}{50}$	$+\frac{1}{60}$	$+\frac{1}{100}$	$+\frac{1}{20}$	–	–	Died	..	..	..	..	..	..	..	..	..	..	—
108	Mar. 27 ,, ..	..	..	–	–	–	–	–	–	–	–	–	–	–	–	Killed	..	..	Few colonies of *M. melitensis* in plate from kidneys.
110	Feb. 10 ,, ..	–	$+\frac{1}{50}$	$+\frac{1}{100}$	–	–	–	–	–	–	–	–	–	–	–	–	Killed	..	—
111	,, 6 ,, ..	–	–	–	$\pm\frac{1}{20}$	–	–	–	–	–	–	–	–	–	–	–	–	Killed	—
112	,, 11 ,, ..	–	$+\frac{1}{40}$	$\pm\frac{1}{20}$	–	–	–	–	–	–	–	–	–	–	–	Killed	..	..	—
113*a*	Mar. 31 ,, ..	..	..	..	$\pm$	–	–	–	–	–	–	–	–	–	–	–	–	Killed	—
113*b*	,, 31 ,, ..	..	..	..	–	–	–	–	–	–	–	–	–	–	–	–	–	Killed	—
113*c*	,, 31 ,, ..	..	..	..	$\pm$	–	–	–	–	–	–	–	–	–	–	–	–	Killed	—
114	,, 8 ,, ..	..	..	..	–	–	–	Died	..	..	..	..	..	..	..	..	..	..	—
7	Bought, June 19, 1907	..	..	..	..	–	–	$\pm\frac{1}{20}$	–	$+\frac{1}{10}$	$\pm\frac{1}{10}$	$\pm\frac{1}{10}$	$\pm\frac{1}{10}$	$\pm\frac{1}{10}$	$\pm\frac{1}{10}$	Killed	..	..	
8	,,	..	..	..	..	–	–	–	–	–	$\pm\frac{1}{10}$	–	$\pm\frac{1}{10}$	–	–	–	Killed	..	—
16	,,	..	..	..	..	–	–	$+\frac{1}{20}$	$+\frac{1}{10}$	$+\frac{1}{10}$	$\pm\frac{1}{10}$	–	$\pm\frac{1}{10}$	$+\frac{1}{10}$	$+\frac{1}{20}$	–	Killed	..	Badly infected. *M. melitensis* in spleen, liver, inguinal, and mesenteric glands.
17	,,	..	..	..	..	–	–	$+\frac{1}{20}$	$\pm\frac{1}{10}$	+	–	–	$\pm\frac{1}{10}$	$\pm\frac{1}{10}$	$+\frac{1}{20}$	–	Killed	..	—
22	,,	..	..	..	..	–	–	Killed	..	..	..	..	..	..	..	..	..	..	—

N.B.—Fractions denote dilution of blood serum.

Infected milk given to all kids only twice between June 11 and July 2.

+ Positive reaction.
– Negative reaction.

When more than one kid was born, one was killed and examined immediately. When only one was born, it was allowed to live for further observation. The kids were given the number of their mother, so that the case could be followed more clearly. The kids were allowed to suck their mothers, and only when the mother died were the kids suckled by another goat. Table B, on page 223, shows the state of the kids during the experiment.

The main point to be observed was whether a kid born of an infected mother acquired immunity to *M. melitensis* infection. For this purpose five kids were bought of approximately the same age as these born at the Lazaretto (about 4 months) for the purpose of comparison. The Lazaretto kids were left with their dams for nearly four months, when they were able to feed on clover, cotton-seed and beans. At this time all the kids were given milk from an infected goat in two doses, one draught in the evening and one next morning. Afterwards they were finally separated from the dams. Since goats No. 111 and 113 yielded infected milk, they were selected to give the milk for this experiment. As, however, goat No. 113 failed quite suddenly to give infected milk, to be on the safe side all the kids fed on the milk of goat No. 113 were fed twice again on the milk of goat No. 111, which contained *M. melitensis* as before. All the kids killed and examined soon after birth were found to be free from infection; their blood did not react, and no *M. melitensis* was recovered from their organs and glands. None of the kids showed a reaction in their blood immediately after birth, but some of them developed the reaction soon after. The parallelism of the reaction of kid and mother was not maintained, as is shown by the following table :—

	February		March	April
	20th	26th	3rd	16th
Goat No. 101	+ $\frac{1}{100}$	+ $\frac{1}{80}$	+ $\frac{1}{100}$	+ $\frac{1}{20}$
,, ,, 110	+ $\frac{1}{150}$	+ $\frac{1}{160}$	+ $\frac{1}{100}$	+ $\frac{1}{20}$
,, ,, 111	–	+ $\frac{1}{100}$	+ $\frac{1}{40}$	+ $\frac{1}{20}$
,, ,, 112	–	+ $\frac{1}{40}$	+ $\frac{1}{20}$	+ $\frac{1}{20}$
Kid No. 101	+ $\frac{1}{50}$	+ $\frac{1}{80}$	+ $\frac{1}{100}$	+ $\frac{1}{20}$
,, ,, 110	–	+ $\frac{1}{40}$	+ $\frac{1}{100}$	–
,, ,, 111	–	–	–	–
,, ,, 112	–	+ $\frac{1}{40}$	± $\frac{1}{20}$	–

+ Positive reaction. – Negative reaction.

From two months after their birth up to their death, none of the kids showed any reaction in their blood. In August three of the

kids developed diarrhœa, and were nearly dying when they were killed and carefully examined: No. 101, bowels congested and mesenteric glands enlarged. No. 114, intestines inflamed, pericardium full of serum, and mesenteric glands enlarged. No. 22, intestines highly congested, stomach full of undigested food, gall-bladder distended with glairy bile, and kidneys much congested. No *M. melitensis* was obtained from any of the organs.

Between the 1st and the 10th of October, all the kids were slaughtered and carefully examined. They all appeared in perfect condition and moderately fat. The organs in all looked perfectly healthy; the spleen was normal, except in Nos. 16 and 17, in which it was friable and juicy. Agar plates were smeared with material taken from spleen, liver, kidney, inguinal and mesenteric glands, and heart. Numerous growths were obtained from No. 16 from spleen, liver, inguinal and mesenteric glands. From No. 108 a few colonies were found on the plate smeared with a portion of kidney; all the other plates showed no *M. melitensis* growth. None of the other kids gave colonies of *M. melitensis*.

The growths from No. 108 were quite unexpected, as the kid had never reacted to *M. melitensis* during life, and no growth was obtained from the spleen and glands, which are much more likely to contain the microbe. Still, the infection of this kid could in no way be compared with that of No. 16, which gave a pure culture of *M. melitensis* in a great number of plates, and which had shown a good serum reaction during life. Of course the finding of the few colonies in No. 108 does not allow one to affirm that the kids born of infected mothers had acquired immunity; but, taking all the circumstances together, one can easily see that the four kids bought outside the Lazaretto showed signs of infection, Nos. 7, 16 and 17 giving a clear reaction all the time, whilst in the Lazaretto kids the serum reaction was never evident.

In conclusion, I think that this experiment gives us *prima facie* evidence that kids born of infected dams have a certain degree of immunity to Mediterranean fever infection. If the experiment be repeated on a larger scale and my conclusions confirmed, a clue to the grave problem of freeing Malta from infected goats may have been found, as it will be a comparatively easy task to replace infected goats by immune kids.

CAMP SANITATION.

By Captain R. TILBURY BROWN.
Royal Army Medical Corps.

This paper consists of extracts from my notes made during the manœuvres last year in Hampshire. The various methods of camp sanitation, which I will describe, were those actually adopted. The variations were made on account of soil, subsoil and other local conditions, as well as for experimental purposes. There is very little original matter with the exception of the urinals and grease traps.

Preliminary Orders.—Before the commencement of a training it is advisable that orders as to the sanitation of the camps be issued by the General Officer Commanding the Division, the Sanitary Officer making suggestions according to the nature of the locality. The orders must be definite and concise, and diagrams are of great assistance to the quartermasters and N.C.O.'s of the Sanitary Sections. I would suggest some such orders as the following, which were issued by the General Officer Commanding 4th Division. (I have made a few slight modifications in the original orders.)

Sanitary Instructions.—(*a*) *Latrines* should be 3 feet long, 1 foot broad, and not deeper than 2 feet. The space between the trenches should be 2 feet 6 inches. They should be arranged as far as possible in one series. When filled in, the next series of trenches may be made in the 2 feet 6 inches interspace if ground is limited. The turf must be removed carefully, and the excavated earth put behind each trench; this earth must be well broken up. Trenches should be carefully and *solidly* filled in and turf replaced. Some kind of implement (*e.g.*, empty tin, tin lid, &c.) should be placed by each trench for replacing earth. Men should be told the necessity for covering their dejecta.

(*b*) *Urine Pits.*—Dig a circular pit 2 feet across and 2 feet deep. If possible fill with *large* stones; leave open if these are not available. From the pit dig two or three shallow trenches 6 feet long (one of 4 feet 6 inches is sufficient for small detachments), with a fall of 1 inch for each 1 foot of length towards the pit; when the trenches are foul, fill in and make others.

(*c*) *Drinking Water, Standpipes and Taps.*—Excavate an area of ground around each pipe or under each tap, size 4 inches deep

and 3 feet square. From the centre of this excavated area dig a small trench, along fall of land, to a pit 2 feet square. Depth of trench 2 inches in above area, and 6 inches outside; breadth about 2 inches. Fill in excavated area with coarse gravel and ram down.

(*d*) *Urine Tubs.*—These should not be placed in the lines, but along the streets and flanks. At least four should be placed close to the canteen. They should be emptied at 10 p.m. and reveille, that is to say, *during* the time they are most used.

(*e*) *Destruction of Refuse.*—Should be carried out according to the instructions contained in the Field Service Pocket Book, 1907.

(*f*) *Empty Tins.*—Should be burnt in the crematory, and may then be removed and buried.

(*g*) *Disposal of Kitchen* (*Greasy*) *Water.*—Dig a small straining pit 1 foot 6 inches square and 6 inches deep. Dig a narrow drain 4 inches wide and 6 inches deep from the small pit to a deep soakage pit 3 feet square and 3 feet deep. Fill the small pit with fresh furze every morning, and burn the old in the crematory. Fill up the soakage pit, as far as possible, with *large* stones. Empty the greasy water over the furze in the small pit *only*.

These were the methods generally adopted, but, owing to the nature of some camps, modifications, as described later, may have to be made.

Sanitary Sections.—These Sanitary Sections performed all the sanitary duties of the camps and were highly satisfactory. They consisted of one N.C.O. and eight men from each regiment. The choice of men rested with the officer commanding the regiment. They were frequently regimental pioneers, but I think that this ought not to be so, for the following reasons:—I consider that (*a*) the Sanitary Sections should be permanently employed as such; (*b*) they should have no other duties; (*c*) they should have special training; (*d*) a certain number should accompany the regimental companies when on the march, and the remainder should be together, under the Sanitary N.C.O., ready to prepare the camping ground at any moment. If regimental pioneers are employed I do not think the above essentials can be complied with. Another point: the system of having Sanitary Sections should not be confined to field service; they should be a part and parcel of the regiment.

After the Sanitary Sections had become accustomed to their work (and the troops to covering their excreta with earth), I turned my attention to the possibility of working the Sections on field days

and on manœuvres. The chief objects were—(*a*) to limit the area of ground polluted, and (*b*) to cover excreta, thus preventing the pollution of large areas of ground wherever a regiment had bivouacked or had made a long halt.

The difficulties were: *In Camp.*—(*a*) Should any men of the Sections leave camp? (*b*) How were they to work? *On Manœuvres.*—(*c*) How were the tools to be carried?

As regards (*a*): If the Sanitary Sections do not leave camp, the work with the companies will have to be done by untrained men. This is most undesirable, especially at first. If they leave the camp (one per company) then the Section must be doubled in order to overtake the camp work. I think that *some* of the Section should leave the camp and accompany the regiment, in the proportion of one to every two companies. The remainder of the Section would work in camp under the direction of the N.C.O. These five should be sufficient while the regiment is out of camp. If a company is separated, and no Sanitary Section man available, a man must be told off from that company for this particular duty. It might be advisable to have one man in each company as a "waiting" member to take the place of a Sanitary Section man if ill, &c.

As regards (*b*), the following orders were issued by Brigadier-General F. S. Robb, Commanding the 11th Brigade:

Instructions for Sanitation on the March.

(1) Men should be ordered always to cover their excreta with loose earth, scraped up with a bayonet.

(2) Men should not, except in very urgent cases, be allowed to "fall out" between halts.

(3) Sanitary Section men, with spades, should accompany battalions on the march, in the proportion of one Sanitary Section man per two companies.

(4) *At a Short Halt* (*under half an hour*).—When the company halts the Sanitary Section man should report to the senior company officer of the two companies to which he is attached, who will indicate to him a suitable place for the men to go to on "falling out." The Sanitary Section man will at once proceed to this spot, and the men wishing to "fall out" will be directed to go to him. He will see that men cover up their excreta with earth before rejoining their companies.

(5) *At a Long Halt* (*over half an hour*) *or when on Outpost Duty.*—The Sanitary Section man will proceed as directed in (4), but, on arrrival at the spot indicated, will dig a few short trenches

for defæcation purposes, and one shallow trench (3 inches deep is sufficient) as a urinal. Men will be instructed to use these latrines and urinals only.

Of the four regiments concerned in the above orders, the commanding officers have reported as follows: (*a*) That no difficulty was experienced in carrying out the instructions. (*b*) That the system will work well and smoothly in time, and that there was a marked improvement as to fouling of ground during halts. No use of bayonets was observed. (*c*) That the instructions were carried out with the best possible results, and that it was found quite easy for the Sanitary men to do all that was required. It was found that, by having breakfast as long before parade as practicable, the numbers of men who wanted to "fall out" on the march were reduced to a great extent. (*d*) That Sanitary Section men do not appear to have been tried on the march, and that there is an objection to Sanitary Section men leaving camp as necessitating withdrawal of rifles. Spades do not appear to have been taken on the march. One spade per company is suggested.

With regard to (3), it has been the custom to carry the necessary tools in one of the waggons; but this is bad, as they will frequently be required long before the waggon can be up. I think that the best way would be for four of the men (1 per two companies) to carry a spade in addition to their kit, or in place of a portion which could be carried in the waggon. The remainder of the Section men (generally four) and the N.C.O. would march together, and have charge of a mule or horse carrying the remaining spades and the picks. Should an animal not be available, they would have to carry the tools themselves. These men, as soon as the camp site is fixed, should commence to dig shallow latrines and urinals, then some form of crematory, and then continue with the camp conservancy. If a certain percentage of entrenching tools are to be carried, then the difficulty is rendered more easy of solution.

Latrines.

The "shallow trench" system was used throughout the camps and was most satisfactory.

Size.—Where the ground was limited, the trenches were dug 2 feet deep, otherwise 1 foot. Their length was 3 feet, breadth 1 foot, and the interspace was $2\frac{1}{2}$ feet. These interspaces were sufficient to allow another series of trenches to be dug in them if ground was limited.

Odour.—There was no smell about the trenches.

Flies.—There was a marked absence of flies about the trenches. In a few instances deep trenches were dug on the arrival of the

regiments and closed after two days. These deep trenches were very offensive, and many flies were present, although the weather was against their presence, the difference from the conditions about the shallow trenches being very marked.

Effect on Excreta.—Several old trenches were opened up. After two weeks there was a slight odour, with signs of fæcal matter. After three weeks there was, practically, no odour or signs of fæcal matter.

Number.—Trenches were generally dug for 5 per cent of the troops.

Time they Lasted.—They generally lasted two days, but in one regiment for four days; this latter was because the earth, for covering, was finely sifted, and the contents of trenches, which tend to get heaped in the centre, were levelled down.

Method of Covering.—Many means of covering the excreta with earth were adopted as: (*a*) empty tins; (*b*) improvised scoops made of empty tins with wooden handles; (*c*) cheap "grocers'" scoops similar to (*b*)—these three (*a*, *b*, and *c*) were good; (*d*) spades; (i.) one G.S. spade to each latrine (in my opinion, insufficient); (ii.) a very small spade to every two trenches—this (ii.) was the best method in standing camps; (*e*) pushing the earth in with the boot. I do not like this method.

Covering of Excreta.—The men required constant checking at first, but by the end of the training they did it naturally, and no trouble was experienced. They greatly preferred these trenches to the deep ones.

Supervision.—The following methods were adopted:—

(*a*) Covering of excreta by Sanitary Squads; I do not like this method, as there can be but slight check on the men, and it does not sufficiently impress on them the importance of doing it themselves. (*b*) Policeing by men who remained on duty until they found another man neglecting to cover his excreta; this was very useful at first, but, later on, unnecessary. (*c*) Policeing by one of the Sanitary Police, who was stationed at the latrines at fixed hours; this method was most satisfactory and generally adopted.

Paper.—In one regiment the paper was kept in tin boxes, which method was found satisfactory. It is a little difficult to prevent paper from blowing out of the trenches during windy weather. The front screen should not be far from the row of trenches.

Handrail.—In some regiments a light handrail was placed along the front of the trenches, about 1 foot high. This was some assistance, especially at first, but I do not think it necessary.

The following are details of most of the latrines:—

Regiment	Strength	Number	Subsoil	Size: Feet	Time lasted: Days	Means of covering	Supervision
1	400	18	Peat; water at 1ft. 6in.	3 × 1 × 1 ..	2	Scoops, "grocers'"	Visited hourly by Sanitary Squad.
2	540	16	Peat; water at 2ft.	3 × 1 × 1ft. 6in.	1	Small spades ..	Policed.
3	590	30	Peat, 9in.; sand; water at 2ft.	3 × 1 × 1ft. 6in.	3	Tins	,,
4	470	25	Peat, 9in.; sand; water at 6ft.	3 × 1 × 2 ..	4	1 G.S. spade ..	,,
5	780	16	Peat, 9in.; sand; water at 6ft.	3 × 1 × 2 ..	2	Tin scoop, wood handle	,,
6	450	16	Peat, 3in.; sand; 1ft.; gravel; water, 5ft.	3 × 1 × 1ft. 6in.	2	Tins	Permanent police.
7	350	24	Peat, 6in.; sand; gravel; water 5ft.	3 × 1 × 2 ..	2	Push with boot..	Sanitary pioneers' cove if necessary.
8	620	12	Peat, 6in.; sand; gravel; water, 7ft.	3 × 1 × 2 ..	2	Tins	Policed.
9	600	20	Sand, 4ft.; gravel; water 5ft.	3 × 1 × 2 ..	1	,, ...	Permanent police.
10	636	30	Sand	3 × 1 × 1ft. 6in.	2	,, ...	Policed.
11	590	30	,, ...	3 × 1 × 2 ..	2	,, ...	,,
12	512	25	Gravel on clay	3 × 1 × 1ft. 6in.	1	,, ...	,,
13	480	19	Loam, 10in.; clay	3 × 1 × 1 ..	1	,, ...	,,
14	480	10	,, 1ft.; clay	3 × 1 × 1 ..	1	Tin scoops with wood handles ..	,,

URINALS.

I tried making urinals by having shallow trenches leading into pits filled with large stones (fig. 1). The trench was for urinating into and the pit to take the excess.

Size. Trenches.—Depending on the strength. For a regiment, two trenches of 6 feet were sufficient. For a small detachment, one trench of 4 feet to 6 feet was sufficient. The gradient from commencement of trench to pit was 1 inch for each 1 foot length. *Pit.*—Depending on the strength: 3 feet deep and 2 feet diameter was generally sufficient.

Time Lasted. Trenches.—About two days. When foul, fill in and dig fresh ones. *Pit.*—About fourteen days.

The result was very satisfactory and preferable to the usual open pit. The surrounding ground was very little fouled; many men could use them at the same time, and smells as well as flies were absent. As the trenches were moved round the pit (like the

arms of a watch), so the opening of the screen was moved round in order to allow the men to enter *between* the arms. Sods may be heaped around and over the pit. This arrangement was particularly successful. Pits with one short arm are useful for small numbers of men or for short occupation. Sods removed when making a trench are heaped along its farther side.

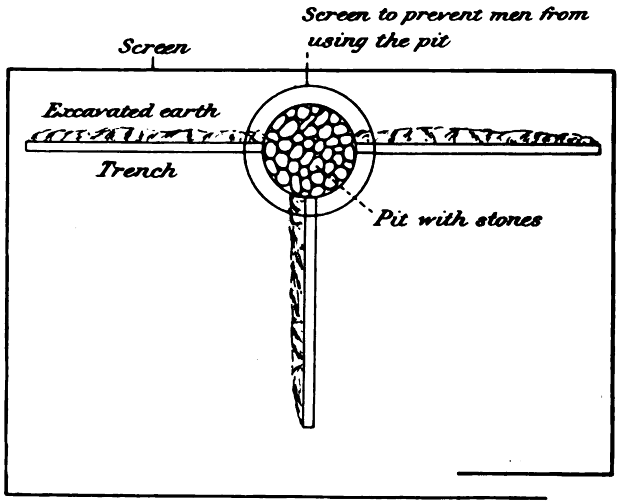

FIG. 1.

Night Urinals.—These were wooden tubs which were placed along the streets and flanks (not in the lines), and by the side of whitewashed posts upon which lights were hung at night. In many cases stands were made for the tubs. Four tubs were placed outside the canteen. Tubs were emptied *during* the time they were mostly used, *i.e.*, 10 p.m. and at reveille. They were not emptied into the urinals, but into special soakage pits. In some cases it was found that urine, in a deep soakage pit, would not soak away rapidly, in which case refilling the pit to about 1 foot 6 inches from the top with the excavated earth, was found to act well. During the day the tubs were either inverted or filled with water. During the manœuvres small shallow urinals were dug every night by one regiment, one for each half battalion; a light was placed by each, and they were filled in the next morning. The result was very satisfactory.

DISPOSAL OF REFUSE.

Camp Refuse.—The four following forms of crematorium were employed:—

(*a*) A high cylinder built of sods, with air inlets at the base (*vide* fig. 2). This is a most efficient method, and suitable when the soil is turf; it burns away if the soil is peaty.

FIG. 2.

(*b*) A low cylinder built as (*a*). Good, but (*a*) is preferable.

(*c*) A pit with central cone of stones. Very efficient and quickly built. Suitable when stones are available. I tried empty tins filled with earth, as stones were not available, but it was not a success (fig. 3).

FIG. 3.

(*d*) A horseshoe-shaped mound of earth. This was found particularly suitable when the earth was peaty, and in loose, crumbly earth, and also when stones are not available.

These crematoria were very satisfactory, and, in the case of pattern (*a*), when once the fire was lighted it kept going for three weeks, and was only relighted twice. The residual ash in the crematory, after three weeks, was very small. The horseshoe pattern left more residual ash; in the low cylinder and (*c*) the destruction was not so complete, and the residue was buried in pits.

Paper, &c., was collected by one regiment in sacks, which were attached to upright posts standing along a flank of the camp.

Food.—Collected in wooden tubs. A good and cleanly arrangement was a light wooden stand for these tubs. Removed by contractors. When removal was inefficient, refuse was readily burnt, especially in crematory (*a*). Empty food tins were all burnt before being placed in a heap for removal by contractors or burying.

Kitchen (Greasy) Water.—All water was strained and run into soakage pits. The following methods were found to be good and easily improvised :—

(*a*) Two large biscuit tins were taken, the inner and smaller one acting as a coarse strainer had its bottom perforated all over with a nail, and, when necessary, was emptied into a refuse tub. The outer and larger tin directed the water over a small pit which acted as a grease trap, and was filled with furze (dried grass, heather or hay), which was burnt and renewed daily. A narrow and shallow trench ran from this small pit into a large soakage pit. If *large* stones are available, the soakage pit should be filled up with them. The spout of the lower tin is easily made by making an inverted V-shaped incision in its side, turning it down and rounding off (fig. 4).

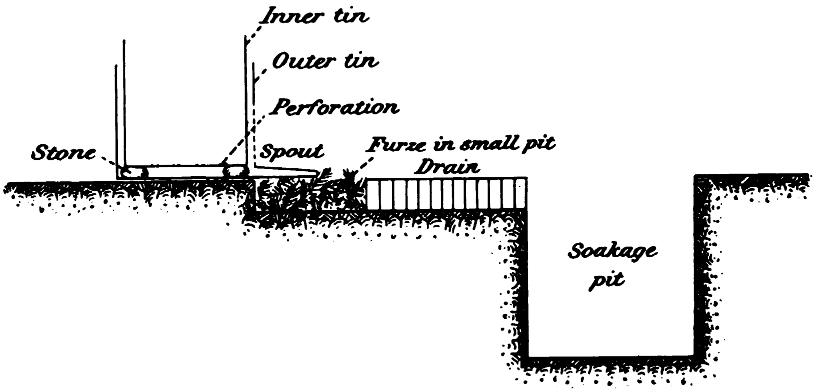

FIG. 4.

(*b*) An adaptation of (*a*): a box turned upside down over the grease trap (pit), a hole cut out in its bottom, and a perforated colander or tin fitted into the hole.

(*c*) A grating placed over the soakage pit on which furze or other straining material is placed. Not so efficient or cleanly as (*a*) or (*b*).

(*d*) An adaptation of (*c*) and better : a small pit acting as a grease trap, with a drain into the soakage pit.

A modification of (*d*): an elaborate grease trap, which led into a drain. A soakage pit was not used in this instance, as the drain answered that purpose.

ABLUTION.

Baths.—I am glad to say that the importance of the personal cleanliness of the soldier is being more recognised, and, in six

out of fourteen regiments, arrangements were made for hot baths when in standing camp. In one case a bathing non-commissioned officer was always on duty, who, besides seeing to the supply of sufficient hot water, had a book in which were entered the name and company of the bather, and so a check was kept on the non-bathers. The hot water for the baths was obtained from portable stoves which held 100 gallons of water. When a man wished to draw a bucketful of hot water he had, first of all, to put a bucketful of cold water into the stove. In this way a supply of hot water was maintained. The various methods employed were :—

Under Cover.—(*a*) A marquee divided into ten compartments by canvas screens; each compartment contained a seat, a foot-grating, and a metal bath. The bath had a wooden plug which opened over a trough made of strips of galvanised iron. Each compartment had a door made of a strip of canvas, which could be rolled up when not in use.

(*b*) A temporary hut made of canvas, stretched over wood. It contained a pair of long seats, foot-gratings, and sixteen baths (metal), which were tipped into a drain. It also had a separate compartment for sergeants.

(*c*) Two circular laboratory tents, each containing ten tubs (iron), which were emptied into a small pit.

(*d*) A temporary hut made with tarpaulin roof and canvas sides. It contained four seats, foot-gratings, and eighteen metal baths, which were emptied into shallow drains. It also had a small compartment for sergeants.

In the Open.—(*a*) Eighteen compartments, with three sides, made of canvas. Each compartment contained a seat, a foot-grating, and a green canvas bath.

(*b*) No compartments. Men had metal baths in the enclosed space by the ablution benches. This method was not so satisfactory as (*a*).

Good bathing-places, in streams, were selected and much used. I occasionally found that the policeman at the bathing pool was unable to swim. Care should be taken to avoid this, and I think it would be better if the bathing picket consisted of two men instead of one.

Ablution Benches.—I do not like the ordinary ablution bench, as, even when foot-gratings are used, the ground around always becomes wet and muddy. Much depends on the slope of the ground. In two cases the ground sloped in a direction which made drainage of great difficulty, and was best remedied by banking up

17

the lower end with earth and making a gradually sloping trench to the other end, from which a drain was cut. Over the trench groundsheets were placed.

The  bench has many advantages (cleanliness, self-draining, &c.), but there are two disadvantages, viz., (*a*) when emptying a basin the water is very apt to go over the other side and wet the man opposite. I suggest an upright plank over the V, thus:—

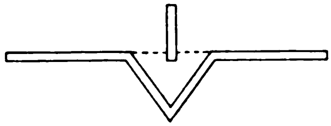

FIG. 5.

(*b*) The square box at the bottom of the overflow requires to be wider, as water splashes over and fouls the ground.

If these defects can be remedied, I think this bench would be much better than the ordinary (grating) bench.

MISCELLANEOUS.

Drying Clothes.—Was generally done on the heather, gorse or trees about the camp. Some regiments had posts and ropes in regular drying grounds; this was an improvement. One regiment had a marquee for drying clothes. It was fitted with posts and ropes, and charcoal braziers standing on the ground. Tins or buckets with holes do for braziers. In this marquee the wet clothing of two companies could be dried in two hours. I should like to see some such arrangement in all standing camps.

Washing-up.—The question of the "washing-up" requires much careful consideration, as well as alteration, and this applies to each system of messing (restaurant or ordinary). The washing-up water ought to be boiled or filtered just as much as the drinking water, but this is nearly always neglected. A particular and separate "washing-up" place is required, a plentiful supply of boiled or filtered water, a supply of well-baked sand (if this is to be used), and supervision of the process of "washing-up" and "sand-baking" by one of the Sanitary Section.

Water Squads.—These were composed of one non-commissioned officer (or senior private) and two men of the Royal Army Medical Corps. There was one squad to each filter cart, and the squad was attached to the regiment concerned. When a senior private is in

charge of a water squad, he should be granted a temporary stripe. This is important. The man in charge of each water squad sent me a weekly written report on his cart and the work he had done.

The Field Service Filter Carts were tried over very *rough country*. They had to be dug out of bogs, were severely shaken over hidden ditches, and tested very highly. The results were good, and the carts sustained no damage, as far as I could ascertain, from the rough work, with the exception of one broken candle.

Output of Water from Carts.—When dealing with *clear water*, it was generally found that it took from twenty-five to thirty minutes to fill a cart and the same time to empty one. At this rate, and allowing the cart to be filled before commencement, the cart could supply about 100 gallons of filtered water in the first hour, and 200 gallons in one hour and a half. One trial gave 140 gallons in an hour. I do not think it is possible to get 210 gallons per hour, including the necessary filling. When very *muddy water* was used, as an experiment, from a muddy and thick stream, it was found to take fifty minutes to fill the cart, and about thirty (as with clear water) to empty it through the candles; that is to say, eighty minutes to supply 100 gallons of filtered water.

Field Laboratory.—I had a field laboratory consisting of a bell-tent, in which I kept stains and reagents, culture media, a microscope, and a portable incubator with stand and lamp. The incubator was made of two tins, the outer covered with felt, with a water-jacket between the two. The lamp was an ordinary paraffin-oil lamp. The stand was made of just such a height that the globe of the lamp was about ¼ inch below the incubator when the latter was standing upon it. A thermometer was used, and, in addition, a clinical thermometer left in the incubator showed what the maximum temperature had been. By regulating the lamp occasionally I found that the variations in temperature were not too great. The total weight of the materials was not great, and could easily be taken on field service. I found the laboratory most useful, notably in the detection of Klebs-Löffler bacillus growth on blood serum in a case of diphtheria, in certain negative results in cases of bad throats occurring about the same time as the diphtheria, in arriving at the cause of an outbreak of diarrhœa, in finding the *Diplococcus gonorrhœæ* in a questionable case of urethritis, and in several other instances.

[For further information, sketches, &c., bearing on this subject, see "Sanitary Report, Hampshire Training and Manœuvre Area, 1907," issued with Eastern Command Orders, February 6th, 1908. —Ed.]

THE INTERNATIONAL CONGRESS OF HYGIENE, BERLIN, September, 1907.

By Lieutenant-Colonel W. B. LEISHMAN.
Royal Army Medical Corps.

It was my good fortune to be directed to attend this Congress as one of the delegates of the War Office, my colleague being Lieutenant-Colonel W. G. Macpherson, C.M.G., R.A.M.C. It had already been foreshadowed in the programme that the task of attempting to give any general idea of the work of the various Sections would be far beyond the capacity of two men, and this became more and more evident as the actual discussions proceeded. Colonel Macpherson and I had arranged beforehand as to a division of labour, and agreed on the discussions which we should, respectively, endeavour to attend; but, in my own case at least, it was found that it was impossible to carry out this scheme as completely as had been hoped. For instance, it not infrequently happened that two of the subjects in which one was interested came up for discussion in different Sections at the same time, while another difficulty was encountered in the alterations which were at times made in the order of the papers. Thus one had often to wait through some discussion, of little direct interest to us, in order not to miss that which one wished to hear; only to find out later that one had missed another of special interest in a different Section. Such difficulties are, I suppose, encountered at every large Congress, and I only mention them by way of apology for the apparent neglect of many important discussions from which one might have hoped to collect valuable information for a report of this nature.

The subjects to which it had been agreed that I should devote most of my attention, were those dealing with the causation of disease and problems of pathological and bacteriological interest; while Colonel Macpherson agreed to study the more strictly hygienic side of the Congress, and, in particular, all that bore upon questions of army sanitation. The same division of labour was adopted in the case of the exhibits in the Exhibition connected with the Congress, and in this direction also there was no lack of material for us both.

The Congress was held in the Reichstag, practically the whole of this magnificent building having been placed at the disposal of the Congress by the German Government. Large as it was, how-

ever, some of the committee rooms, in which the various Sections held their meetings, were uncomfortably crowded when the subject under discussion was one of general interest; but this can hardly be wondered at, as I believe the attendance was close upon 4,000 members! In spite of this enormous number, and the fact that so large an attendance had not been anticipated, the natural talent of our hosts for organisation carried them successfully over all difficulties, and no efforts were spared to make smooth the way of the stranger within their gates.

In the subjoined report upon a certain number of the discussions I must mention that, in some instances, I was not able to attend the whole of the particular sitting or sittings at which they took place; when this was the case I have endeavoured, as far as possible, to fill up the blanks in my notes and in my memory from the printed summaries which were sometimes available and from enquiries among those who had been present. It is possible that in this way some errors and omissions may have occurred, which I regret but which it was not possible to avoid.

I may, in the first place, give a list of the subjects which were discussed at the various Sections, as an illustration of the enormous range of modern hygiene. The Sections were eight in number, No. 6 being subdivided into two on account of the large number of subjects to be dealt with, and the custom in each instance was to open the discussion with the reading of three or four set papers on the subject by *Referenten*, or reporters, who had undertaken this task on the invitation of the Executive of the Congress. After this, the subject was thrown open for discussion, and the readers of the original papers were given an opportunity of replying, when all who wished had spoken.

Section 1.—Microbiology and Parasitology in their Relations to Hygiene.

List of Subjects.

(1) The ætiology of tuberculosis.
(2) The bacilli of the typhoid group.
(3) The cocci of meningitis and similar bacteria.
(4) The ætiology of syphilis.
(5) Pathogenic protozoa.
(6) Pathogenic spirochætæ.
(7) Insects as carriers of disease.
(8) The methods of testing sera.
(9) Modern methods of immunisation.

Section 2.—Dietetic Hygiene and Hygienic Physiology.

List of Subjects.

(1) The control of food supplies in different countries and the legislative measures bearing upon them.

(2) Methods employed in the preservation of foods.

(3) Legislative requirements in connection with food.

(4) The diet of the poor and its effect on the social economy.

(5) The necessary minimum of proteids.

(6) Alcoholism.

(7) Bathing and its effects on health.

Section 3.—The Hygiene of Childhood and of Schools.

List of Subjects.

(1) The care of infants.

(2) Homes for children and the results which they have given.

(3) Lectures on infantile hygiene as a means of raising the standard of qualification of midwives.

(4) The production of pure milk for infants.

(5) The system of school physicians.

(6) The question of overwork in schools.

(7) The best method for regulating holidays.

(8) The care of the weak-minded.

Section 4.—The Hygiene of Trades and the Care of the Working Classes.

List of Subjects.

(1) Fatigue from work.

(2) The success following preventive measures against accidents.

(3) Instruction in hygiene for inspectors of industries.

(4) Dwelling-houses for workmen.

(5) Public baths and baths in factories.

(6) Industrial lead-poisoning.

(7) Experiments on the prevention of dust in trades.

(8) The dangers of electricity and the assistance to be given in the case of accidents arising from the use of strong currents.

(9) How to reduce the dangers to health in industries carried on in the home.

(10) Ankylostomiasis.

(11) Substitution of a harmless procedure for the tanning by mercury.

(12) The disease of caisson workers.

(13) The improvement of hygiene for the working classes by means of insurance.

Section 5.—The Prevention of Infectious Diseases and the Care of the Sick.

List of Subjects.

(1) Uniform regulation of the methods of testing disinfectants and disinfectant apparatus.

(2) The control of disinfection.

(3) Insurance against disease and its results.

(4) The prevention of tuberculosis and the care of consumptives.

(5) Protective inoculation against typhoid fever, plague and cholera.

(6) The prevention of contagious meningitis.

(7) The prevention and spread of plague.

(8) Modern methods of combating typhoid fever.

(9) The measures for preventing the transmission of infectious diseases by vaccination.

(10) Compulsory meat inspection with reference to the prevention of disease.

Section 6 (A).—The Hygiene of Dwellings, of Towns, and of Water Supplies.

List of Subjects.

(1) Provision of dwellings for the poor.

(2) Homes for unmarried persons.

(3) Reports on the results of the mechanical, chemical, and biological purification of sewage.

(4) Recent experience of the separating system of water supplies.

(5) The utilisation and removal of sewage sludge.

(6) The influence of clarified sewage upon the condition of rivers.

(7) New methods of filtering drinking water.

(8) The sterilisation of water by ozone.

(9) Experiments in connection with water collected by means of dams in valleys.

(10) Modern appliances for lighting and their hygienic importance.

(11) The importance of artificial ventilation.

(12) The smoke nuisance in large towns.

(13) The hygiene of public thoroughfares.

Section 6 (B).—The Hygiene of Traffic. Life-Saving.

List of Subjects.

(1) The health of those employed in connection with traffic.

(2) The food supply for travellers, and its supervision.

(3) The dangers of epidemic disease in the railway service, and their prevention.

(4) The dangers resulting from the employment in the railway service of persons affected with nervous complaints.

(5) Injuries incurred in railway travelling, and their prevention.

(6) First aid in the case of street accidents. First-aid organisation in general.

(7) Medical co-operation in the preventive measures taken against the dangers of traffic.

Section 7.—Military, Naval, and Colonial Hygiene.

List of Subjects.

(1) The water supply for an army in the field.

(2) Reports on inoculation against typhoid fever in the Army.

(3) The examination of officers and men as to their fitness for active service in tropical countries.

(4) The disposal of waste in military camps and in the field.

(5) Wholesale poisoning of troops by adulterated food.

(6) The relation between pulmonary tuberculosis and functional diseases of the heart in soldiers.

(7) Ships infected with plague rats.

(8) Sleeping sickness.

(9) The malaria campaign.

(10) Ventilation and heating on board ship.

(11) Vaccination against small-pox in the Tropics.

(12) On sanatoria in the Tropics.

(13) The campaign against yellow fever.

(14) The permanent sanitary supervision of ports.

(15) Lavatories, baths, and water-closets on board men-of-war.

(16) The regulation of the bodily temperature in tropical climates and in Naval service. Sunstroke.

(17) The prevention of infectious diseases on board ship.

Section 8.—Demography.

List of Subjects.

(1) Death tables.

(2) The duration of life of the population.

(3) Statistics of infant mortality. Influence of food on mortality. Control of milk. Mothers' nursing.

(4) Statistics of the movement of the population in the German Empire and statistics of plural births.

(5) Statistics of families.

(6) Statistics of recruiting.

(7) Inland immigration.

(8) Emigration and immigration.

(9) The hygiene and statistics of schools.

(10) Morbidity and mortality of different professions.

(11) Statistical forms for the record of cause of disease and death.

(12) Mortality and wealth.

(13) Supervision of dwellings. Statistics of dwellings.

(14) Comparison of registers of general mortality with registers of life, income, and pension insurance.

(15) The frequency and the results of accidents.

(16) The development of fecundity.

THE BACILLI OF THE TYPHOID GROUP.

The discussion on this subject was opened by Loeffler, who gave an account of the various members of the group, laying stress on the extent to which they varied with respect to pathogenicity. Going into the question of classification, he proposed to include them all in one family, for which he suggested the name *Typhaceæ*. After pointing out the morphological and cultural characteristics which were common to the whole of the family, he went into detail with regard to the distinguishing features displayed by the various members on such points as motility and the possession of flagella, indol formation, fermentation of different sugars, pathogenicity for experimental animals, and their effects with agglutinating sera. To distinguish them he recommended the use of two special culture media: one for the typhoid group, containing peptone, nutrose, lactose and grape-sugar, and coloured with malachite green; the other, for the paratyphoid group, being of the same constitution with the exception that it did not contain any grape-sugar. By means of their behaviour in these two media he divided the members of the Family into three groups or sub-families:—

(1) *Typhæ*.—He distinguished five forms in this group, and their special behaviour with regard to the two solutions is that they form no gas in either, and that they form a precipitate in the "typhoid" solution but not in the "paratyphoid."

(2) *Josarceæ*.—Contains eight forms, which all decolorise the "paratyphoid" solution and form gas and foam in the "typhoid" solution.

(3) *Coleæ*.—Containing two members, which produce gas in both solutions.

Loeffler concluded by proposing to the Section the formation of an International Commission for the purpose of settling the problem. This was adopted, and five bacteriological institutes—three German, an Austrian, and a French—were approved as places in which the necessary observations should be carried out.

Lentz (Berlin) followed, dealing with the question more from its pathological side. The progress of events in both typhoid and

paratyphoid fevers was the introduction of the specific germs into the lymphatic circulation from the digestive tract. Multiplication of the germs takes place there and also in the mesenteric glands, spleen, and bone-marrow. Thence they are washed into the blood-stream, and pass through the liver with the bile and through the kidneys with the urine. Multiplication does not occur in the intestines, where, on the other hand, the germs are killed off. Passing to the differential diagnosis of the two fevers, he said that the only certain method was a bacteriological examination; they could not with certainty be distinguished by their clinical signs, owing to the great individual variations of the clinical picture in each disease. He next discussed the close affinities which exist between the paratyphoid bacteria and such organisms as *Bacillus typhi murium*, *B. suipestifer*, and *B. enteritidis* (Flügge-Kaensche). As regards the bacilli of meat-poisoning, he pointed out that the preliminary symptoms of intoxication, caused by the bacterial toxins contained in the meat, may be followed by a bacteriæmia similar to that of enteric fever and giving rise to similar histological changes, as seen at the autopsies. The bacilli of this group—of which Gärtner's bacillus is the type—are closely allied, perhaps identical, with the rat bacilli, such as the organisms of Dunbar, of Danysz, and of Issatschenko.

Courmont (Lyons) and Lesieur then spoke of the occurrence of paratyphoid fever in France, and said that properly authenticated cases were rare in that country. It was absolutely essential to make the diagnosis by means of blood cultures, as the serum reactions were very misleading.

Professor Babés (Bucharest) should have read the fourth paper, but was absent, and the discussion was then thrown open to the Section, and was contributed to by Chantemesse, Yhon (Vienna), Stern (Vienna), Uhlenhuth, Eisenberg and others. Most agreed on the necessity for bacteriological examination by means of blood cultures in the differentiation of typhoid and paratyphoid fevers, but there was a considerable difference of opinion as to the possibility of distinguishing them by clinical signs. Uhlenhuth said that paratyphoid bacilli were frequently to be found in pigs, and suggested this as a possible source of infection for man. Levy (Strassburg) stated that in paratyphoid fever the bacilli were to be found in the blood in three-quarters of the cases.

Modern Methods of Immunisation.

This important subject naturally attracted much attention, and gave rise to one of the longest discussions of the Congress.

The protagonists or *Referenten* were Wassermann, Bordet and Paltauf, and the discussion which followed the reading of their communications extended over two meetings of the Section, and was only concluded on the last day at 8.30 p.m.

In opening the discussion, Wassermann dealt principally with the various methods by which active immunisation may be produced. His communication was an excellent summary of most of the recent work in this branch, and was enriched by his own experience and criticism. His article did not lend itself to abstract treatment, but was one which would be well worth studying when published in full. In alluding to "opsonins," he considered them identical with the amboceptors of Ehrlich's theory.

Bordet, who followed, said that, on the whole, we had not made any great departure from the original principles of active immunisation, as enunciated by Pasteur. Much, however, had been done to investigate the causes of the failures and poor results sometimes obtained, and in this connection he emphasised the importance of "anaphylaxis," whose nature and mode of action is still obscure. An attenuated (living) virus is, theoretically, that from which the best results are to be hoped; but it has been found possible to employ this method only in a small percentage of bacterial infections. Another great difficulty, which is a serious barrier to further progress, lies in the uncertainty which still obtains as to which are the special immunising principles in a bacterial culture. This is particularly the case in tuberculosis, where the relative importance of the part played by the bacterial bodies on the one hand, and the diffusible products of the bacilli on the other, has not yet been accurately determined. On this account there have been a multitude of different vaccines suggested and employed in this disease, and in many others. Again, the special substances which appear in the blood of the immunised animals are very numerous; and we are in similar doubt as to the value to be assigned to each in judging of the efficacy of a given method of immunisation. In some instances the "sensibilisatrices" (amboceptors) are undoubtedly of great, if not of paramount, importance, but their importance in other diseases is by no means so clear. The question as to the possible identity of Wright's "opsonins" with either the amboceptor or the complement, is of great importance in this connection, and ought to be further investigated. [*Note.*—There appeared to be a general feeling, among the Continental bacteriologists with whom I spoke on this subject, that the "opsonins" were no more than the immune body or amboceptor under a fresh

name, but in most instances the reasons given were founded on theory, and not on personal experiment on this line.] He was inclined to attach great importance to the endotoxins, and he described some of the recent methods by which it had been found possible to withdraw these from the bacterial bodies. "Aggressins" he did not consider to be separate bodies, and he thought that their importance had been exaggerated. Another point on which we are in ignorance is as to what constitutes virulence. In the case of certain organisms, such as staphylococci, streptococci and anthrax, the possession of a capsule or sheath, by which they protect themselves against phagocytosis, seems to be the factor on which their virulence depends, but in many others nothing of this sort has been observed. In concluding he advocated, in the case of tuberculosis in particular, that investigations as to the best method of immunisation ought to be placed on an international footing, in order that the work might be better systematised and brought to a more speedy conclusion.

Paltauf (speaking for Calmette as well as for himself) discussed the intimate nature of the process involved in serum therapy. For him, the endotoxins play the most important part; they are to be regarded as toxic *antigènes*, and, when inoculated, give rise to the formation of anti-endotoxins; they are produced from the bodies of the bacilli, but may also be contained in the filtrates derived from bacterial cultures. For the preparation of an effective serum, its anti-toxic power is the important element, and the stronger this anti-toxic element the better the serum. In order to judge of the immunising efficacy of a serum, one is justified in drawing conclusions only from experimental results in the case of animals in which the disease assumes a form closely akin to that of the natural form of infection. The specificity of endotoxins is not as pronounced as that of antitoxins.

In the discussion which followed, Bail (Prag) spoke on aggressins and "aggressivity"; he stoutly maintained his original views on these subjects, in spite of the large amount of opposition with which they have met. He found little support, however, from the majority of the speakers who followed.

Kraus (Vienna) confined his remarks to the nature of the toxins and antitoxins concerned in the case of the cholera vibrio and the typhoid bacillus. It was possible to demonstrate the presence of an antitoxin in the serum of infected animals which was capable of neutralising the toxin, either in the body of the animal itself or *in vitro*.

The numerous others who spoke dealt with such problems as the "deviation of the complement," the chemical nature of bacterial toxins, immunisation with tuberculin, bactericidal leucotoxin, streptococci and anti-streptococcic serum, and other subjects.

The Serum Therapy of Typhoid Fever.

This subject was dealt with at one of the general meetings of the Congress by Professor A. Chantemesse (Paris). In his address he gave a most interesting account of his recent experiences in treating cases of enteric fever with the anti-typhoid serum which he has employed and advocated for some years past. The results which he announced were sufficiently striking to arrest general attention. During the last six years (1901 to 1907), he had treated 1,000 cases in his hospital at Bastion, with the extraordinarily low case-mortality of 4·3 per cent. This figure he contrasted with that obtained from the other hospitals of Paris during the same period, where, out of 5,621 cases, there were 960 deaths, or a case-mortality of 17 per cent. Apart from the employment of the serum, his treatment approximated to that of his colleagues in other hospitals, namely, the employment of the cool bath at 24° to 30° C. He insisted, with justice, on the fallacious nature of statistics which deal with small series of cases only, especially in view of the well-known variations of virulence in different epidemics, and he instanced from his own experience a series of 100 consecutive cases of enteric without a death. The figures which he gave had been obtained from the hospital registers themselves. Bearing these and other fallacies in mind, he had analysed the statistics of the fourteen Paris hospitals, which furnished the 5,621 cases which served as controls to his treatment, and he found that in no single instance did the mortality fall below 14 per cent., while, as above stated, the average was 17 per cent. Other results, as good or nearly as good as those of Chantemesse himself, had been obtained in the cliniques of others who had employed his serum. As to the possible influence of the cool bath treatment on the favourable case-mortality, he pointed out that he only used the cool and not the cold bath, at 20° to 22° C., as advocated by Brand. In instances where the latter treatment had been carried out on a large enough scale to make the results significant from a statistical point of view, the lowest case-mortality recorded had been 8 per cent.

The effects of the use of the serum on the symptoms and on the course of the fever are very striking and constant. Following on the injection of the serum there is in the first place a stage of

reaction, lasting from a few hours to five or six days. During this time the temperature does not undergo any modification from the ordinary type; it may even rise somewhat higher. Then follows the second stage, in which there is a steady and often rapid decline in the temperature curve, accompanied by a marked feeling of betterment in the patient himself—so much so that he may feel fairly well and find his appetite improving even at a time when the height of the fever necessitates the employment of two or three baths a day. Vaso-motor changes are also in evidence, the usual cold extremities and blanched face giving place to a more healthy condition, while the stupor disappears, and the general condition is much improved. The cutaneous hyperæmia often persists for some time, even into convalescence, and the general appearance of the patients is widely different from the type which is looked upon as being characteristic of this fever. The earlier the serum treatment is commenced the better, and Chantemesse stated that he had never lost a patient in whom the treatment was commenced during the first seven days of the disease. Started later than this the results are not quite so favourable, as the damage already done to the tissues cannot be put right so rapidly. Among other symptoms which follow the use of the serum, he mentioned that the blood pressure was raised (so that it was seldom necessary to employ cardiac tonics), the pulse falls with the temperature, there is also a marked increase in the quantity of urine, which occurs soon after the serum has been given, instead of on the establishment of convalescence as is usually the case. The most important changes, however, are those which occur in the tissues which are the chief sites of the bacterial struggle, the blood, the lymphoid tissues and the bone-marrow. A leucocytosis of $\frac{1}{4}$ to $\frac{1}{3}$ is usually seen, the mononuclear cells being those whose numbers are increased; the eosinophiles, which are always absent during an attack, rapidly reappear after the serum treatment has been started.

As to the significance of the blood changes which follow the serum injection, Chantemesse said that these were principally to be seen in the increased capacity of the leucocytes of the patient's blood for the destruction of the invading bacilli, and he made the remarkable declaration of his adherence to Sir A. E. Wright's views on immunity: "*Il s'est fait dans le sang du malade une opsonisation antityphoide.*" The effect of the serum on the spleen is remarkable; exact measurements were made by means of the phonendoscope, and these showed that it increased appreciably in size after the injections, and he attributed to this hypertrophy an important part

in the origination of the beneficial changes which are found in the blood itself. In general, the duration of the fever is shortened and its severity is modified favourably by the use of the serum. In very severe cases, or in those in which the serum treatment has been commenced late, the fever may run a longer course, and its favourable effects appear to wear off after about eight or ten days. The *local* injection of a minute dose of the serum in certain forms of post-typhoid osteitis, or periostitis, he has found to be very beneficial in relieving the pain and bringing about rapid cure. Complications are few, as is indicated by the low mortality; and he has only had four cases of fatal hæmorrhage, which he thinks due to the employment of ergotin and calcium chloride. As regards perforation, he has never seen a case where he was able to commence the serum treatment before the seventh day, and this he thinks due to the effect of the serum in warding off damage to the intestinal mucosa, if given sufficiently early.

He next described the method which he had devised for the early diagnosis of enteric, by applying to this disease the principles of the ophthalmic reaction of tuberculin as introduced by von Pirquet and Wolff-Eisner for the diagnosis of tubercular affections. He was led to experiment in this direction on account of the importance of commencing the serum treatment at an early date, before help could be obtained from the appearance of the specific agglutinins. He gave a detailed account of the method which he employed in the preparation of the typhoid toxin used for the test, and described the manner in which this was carried out. Great accuracy is required in the dosage, and the proper amount is dropped into the conjunctival sac. At the end of two or three hours the effects of the toxin become manifest, and they attain their maximum in six to eight hours; they are similar in kind, but milder in degree, than those which follow the ophthalmic test for tubercle. The essential part of the reaction lies in the persistence of the irritation and injection of the conjunctiva for one or more days, which only occurs in true cases of enteric fever. He had never seen a true case fail to give this reaction, and had never seen other cases react for more than one day. In his experience, the test was a very valuable one, especially in view of the early date at which it could be carried out with positive results. He had never seen any permanent consequences. After describing anew the method by which he immunised his horses, and mentioning incidentally that the best sera he had obtained were from animals which it had taken several years to immunise, he went on to

describe his system of treatment. Doses of a few drops only are given, and, since the effects of the first dose last about ten days, he rarely finds it necessary to repeat the first injection; if a second proves necessary, he only gives about one-half of the original dose. The serum is injected hypodermically in the upper arm. He then entered into the problems of immunity involved in the use of his serum, and, as already mentioned, concluded that the most important part was of the nature of a reinforcement of the phagocytic action of the leucocytes and the fixed cells of the tissues against the invading bacilli.

After describing the progress of events in the case of animals experimentally infected, he went on to apply these results in an explanation of the probable action of his serum in modifying an attack of enteric fever in man. He showed curves of the opsonic power of the blood in mild and in severe cases. In the former instance he found that the curve remained above the normal for a month or more after convalescence. In the more severe cases the curve rises after the injection of the serum, but later and to a greater height, and there is thus brought about an intense destruction of the bacilli and a liberation of their toxins. This liberation of toxins may account for the production of the reaction which follows the use of the serum, and also indicates the necessity for the employment of very small doses, especially if a second one is found to be necessary. The cool baths, he thought, should always be combined with the serum treatment, as they help to support the system against the intoxication due to the destruction of the bacilli, and he thought that their use could only be dispensed with when a serum should be prepared which combined with its opsonising power a strong antitoxic action.

The Campaign against Malaria.

The discussion on this subject took place in the Section of Military, Naval and Colonial Hygiene, and, although it was apparently of little interest to the civilian members of the Congress, there was a good attendance of those whose duties take them into tropical countries.

The paper of Ross has appeared *in extenso* in the Journal of the Royal Army Medical Corps. In it he gave an extremely interesting account of the progress of the anti-malarial measures which had been carried out in the British Colonies, as well as in Egypt, Greece, and Panama, pointing out the special features of each campaign and commenting on the varying degrees of success which had attended these efforts. In concluding he advocated that

the Section should pass a resolution pointing out the necessity for obtaining full and regular reports from malarious countries as to the prevalence and prevention of the disease; and he recommended the appointment of special commissioners for this purpose, in order to correlate and superintend the work. At the end of the meeting this resolution was declared to be carried, but there appeared to be some doubt on the matter, as it was put to the meeting at the same time as another resolution on a different subject.

Galli-Valerio spoke of the introduction of malaria into Switzerland by the Sicilian navvies, who came to work at the tunnels, and went on to discuss the various preventive measures which might be put into force. These he divided into five groups: (1) The destruction of the parasites in the blood of sufferers; (2) the immunisation of men against the parasites by means of quinine given prophylactically; (3) the protection both of the sick and the healthy against mosquito bites by means of nets; (4) the destruction of mosquitoes and their larvæ; and (5) the removal of the various causes predisposing to malarial infection. He pointed out that each case must be decided with reference to the local conditions, and that at times only a few and not the whole of these measures could be put into force. He advocated the sale of a pure form of quinine to the people, and, if necessary, its free distribution by the Government. It was essential in every case to complete the campaign by educating the people in a knowledge of the manner in which the disease is caused and spread, and in the necessity for the various measures which were undertaken for their benefit.

Celli then spoke on malaria in Italy and on the measures which had proved most successful in controlling the disease in that country. The destruction of mosquitoes had not proved to be practicable in the case of large tracts of swampy country, and in such cases they relied chiefly upon net protection, both of houses and individuals. The prophylactic use of quinine he looked on as excellent, especially as it was on the youngest forms of the parasite that it was found to work most quickly and thoroughly. He described the steps taken by the Italian Government to secure the distribution of the drug among the peasants, and he put special stress upon the form in which it was taken, advocating its being given in sugar-drops or in the form of chocolate tablets. The various measures possible did not exclude but supplemented one another.

Savas, of Athens, discussed the question as it affected Greece, classifying the various alternatives according as they were possible of immediate application or such as would take a long time to

organise and carry into effect. In the latter class he placed such measures as drainage of swamps, regularisation of river-beds, afforestation, &c. In the class of those measures which might be carried out at once, he placed the education of the people in the nature and method of infection, the sale of quinine and the control of quinine prophylaxis by the Government, and the granting of legal powers to compel the sanitation of small collections of water near houses and small villages.

Ruge then dealt with the problems which the Germans have had to face in their African Colonies, laying stress, in common with the previous speakers, on the need for deciding on the necessary measures with due regard to the local conditions. He discussed in detail the methods by which the systematic administration of quinine could be best controlled and from which the best results were to be expected. It ought to be taken for at least two months subsequent to an attack of fever. In cases of malaria which occur in those who have been taking quinine regularly, he found that the disease ran a milder and more regular course and was less likely to be followed by blackwater fever. Neither net protection nor mosquito destruction had, as yet, been carried out to any great extent, but in some instances had given excellent results.

The discussion which followed brought no very new facts to light, and the same may be said of the original papers themselves; but it was interesting to hear how the problem of malaria prevention was viewed by workers from so many different countries, and satisfactory to gather that there was a general agreement as to the efficacy of the methods in general use, if conscientiously carried out.

MODERN METHODS OF COMBATING TYPHOID FEVER.

In opening this discussion Frosch (Berlin) said that, in endemic typhoid, infection was most commonly spread by contact, and the dangers were very greatly increased by the mild ambulatory cases and by those who, in convalescence, continued to void typhoid bacteria in their urine or their fæces. Bad hygienic surroundings also favoured the spread of the disease. Drinking water he regarded as only of secondary importance, and he did not think that it accounted for many cases; the chief danger, he thought, was in connection with the retail supply of milk. In the case of certain trades where there was a large amount of going and coming among the workers, there was a constant danger of the importation of fresh cases. In attempting to stamp out the disease, all the typhoid "carriers" must be detected and isolated, and attempts

must be made to improve the general hygienic conditions of the inhabitants as far as possible.

Almquist (Stockholm) strongly advocated the adoption of Koch's method in its entirety, and thought it could hardly fail to stamp out the disease if thoroughly carried out. He mentioned that in Sweden they have provided a travelling typhoid laboratory, containing all the equipment required for dealing with an epidemic, which, on notice of an expected outbreak, is at once sent to the threatened district.

Schneider (Saarbrücken) thought that such a campaign ought to include a war against allied bacteria and paratyphoid, dysentery and the like, as well as against Eberth's bacillus. He advocated a thoroughly organised system of dealing with the problem, the details of which he had evidently thought out with great care. Among these may be mentioned the proposed formation of a number of special laboratories throughout the danger zone, whose staff should undertake the diagnosis, the investigation of the probable cause, the enquiry into the sanitary environment of cases, and everything pertaining to the epidemiology of the outbreak. The staff should be large enough, and the allotted district small enough, to allow of one of their number being despatched at short notice to investigate each case on its being reported. He laid stress on the necessity for uniformity in such matters as the instructions to be given as regards prophylactic measures, the system of reporting cases and of compiling accurate returns, and of maintaining touch with the other laboratories. He also suggested that they should undertake research work in connection with the prevention and treatment of the disease. He strongly advocated the isolation of all cases, and said this could best be done in hospitals, and if more hospitals were required for the purpose, such should be provided by the State, which should also be prepared to pay for the cost of admitting and treating poorer patients. For those who could not be taken into hospital, trained sick attendants ought to be provided. The scheme should also provide for the training of a body of professional disinfectors, and for their effective supervision by the staff. The prophylactic measures adopted in each case should only cease when bacteriological recovery has been proved. He would not suggest the keeping of obstinate "carriers" in hospital longer than ten weeks on account of the expense involved, but would then discharge them after thoroughly warning them of the danger they were to others, and instructing them in the measures of personal cleanliness which they must adopt. Stronger measures would,

however, be necessary in the case of individuals concerned in the distribution of food, and in the case of prisoners or lunatics confined in asylums. He emphasised the importance of securing the co-operation of the local physicians, and the need for supplying them gratis with the necessary outfit for sending material to the laboratories for examination.

ANKYLOSTOMIASIS.

Löbker (Bochum) said that infection in this disease occurred either by entrance of the encapsulated larvæ through the mouth, or, when the capsule had been got rid of, through the skin. He pointed out that the majority of persons who are infected show little in the way of symptoms, as these are slight unless there are a large number of parasites present in the intestine and the condition is aggravated by the age of the individual, the long duration of the infection, and other factors. The disease may be cured spontaneously, provided the man is not exposed to fresh infection. Treatment directed to the expulsion of the worms will also cure, and the same treatment used prophylactically will prevent infection. For the effective checking of the spread of the disease it is necessary to make a careful search for all the carriers of the parasites. Extracts of Felix mas and thymol are reliable drugs, but must both be given with care as neither is quite free from risk.

Bruns (Gelsenkirchen) next described the measures which had been successful in checking the spread of the disease in certain mines in Rhenish Westphalia. These measures were chiefly directed to the detection of all men who were harbouring the parasites. This, he said, could only be done by the systematic examination of the fæces of every miner, as by far the larger proportion of carriers were found to be men apparently in good health, who were not showing any of the symptoms of the disease. The main centres of infection are the heaps of excrement in which the encapsulated larvæ develop, and he did not think that the larvæ were capable of travelling far from the site in which the ova were deposited. They might also be carried away from the spot by water, but he did not believe that a sudden spread of the disease in epidemic form had ever been caused by water, and he protested strongly against the abandonment of the system of irrigation of coal mines, which has so beneficial an effect in lessening the dangers of explosions of coal-dust. All the men who were found to harbour the worms were isolated, and were not allowed to return to work until they were cured. The men were also instructed in the causation of the disease, that they might guard against infection

as far as possible, and also prevent others from becoming sources of danger, by defæcating in open places. Closets must be provided both above and below ground, and kept in good sanitary order. As an instance of what may be done by thorough and repeated examination, in combination with the other measures which he advocated, he mentioned the case of a mine in which 2,200 men worked; 35 per cent. of them were found to be infected, but by application of the above principles this incidence dropped to 0·1—0·2 per cent. In some mines the whole gang of workers were examined ten to fifteen times in succession. The system entailed heavy pecuniary sacrifices both on the owners and on the men, and it was only by the willing co-operation of both parties that such successful results could be obtained.

Conti (Cremona) then read a paper on much the same lines, and advocating the same measures, namely, the systematic and repeated examination of all workmen to detect those who harboured the parasites, and the keeping of such infected men away from work until they were proved to be free from the disease. Thymol he regarded as the best remedy, but it was sometimes necessary to give it in large doses of 8-10 grammes, and to extend the treatment over a long period, possibly some months. Among other points he advocated the compulsory use of machines in brick-making, to lessen the dangers of contact of the clay with the skin, and the use of quicklime for the disinfection of excreta.

The next paper was by Malvoz (Liége) and was read for him in his absence by Delbasteille. It described the state of the question in the Belgian mines, where a careful examination had disclosed that 26 per cent. of the whole mining population were carriers of the parasite in 1902. In 1903 a systematic campaign was started, every carrier was subjected to treatment, and no owner would engage a man unless he had a certificate to say that his stools had been microscopically examined. The men were treated in special dispensaries and educated in personal hygiene before returning to duty. The incidence has now fallen in the Liége district to 5·5 per cent. He mentioned further that indemnities had been granted to sufferers by the Province for their compulsory abstention from work.

The Cocci of Meningitis and Allied Bacteria.

von Lingelsheim (Beuthen) spoke of his experience of epidemic cerebro-spinal meningitis in Upper Silesia in 1904 and 1905. He confirmed the original description of the meningococcus given by Weichselbaum, and went into detail as to its morphological and

cultural characteristics. The coccus he found was very readily killed by desiccation and difficult to sub-culture. It required for its cultivation a medium containing an albumin of relatively high constitution, such as blood serum or ascitic fluid, and he mentioned that it was always best to use a transparent medium, as the growth on these enabled the coccus to be more readily differentiated from the allied organisms, which are found in such abundance in the naso-pharynx. The morphological characters and the intra-cellular situation of the cocci by themselves were quite insufficient to distinguish the organism, which must be submitted to cultural tests as well. He then proceeded to give the cultural distinctions between the meningococcus and the following organisms, for which it might be mistaken: the *Diplococcus crassus*, the *D. mucosus*, the *D. cinereus*, and the *D. flavus III.* In addition, the *Micrococcus catarrhalis* and the *D. flavus I.* and *II.* had to be taken into consideration. He then spoke on the value of the agglutination test with a specific serum, and alluded to the possibilities of the method of fixation of the complement, which had not yet been sufficiently tried.

Ghon (Vienna), who followed, classed the meningococcus among the micrococci; and testified to the stability of its cultural and other reactions, which, in his opinion, marked it out sharply as a distinct species. He had seen no evidence of the "mutability" of character described by other observers, and considered the organism of Weichselbaum to be the specific and sole cause of a special form of meningitis, which was met with not only epidemically but also in sporadic form. The usual channel of entry was the nasal cavity, and it might exist there in saprophytic form or give rise to a manifest inflammation. Such inflammation may remain localised or may extend to the meninges, even in the absence of previous disease of the nasal fossæ or of the cavity of the tympanum. Two other organisms which are very closely allied species are known to be pathogenic for man, the *M. catarrhalis* of Pfeiffer, and the *M. gonorrhœæ* of Neisser. There are, however, a large number of non-pathogenic organisms which closely resemble it and make the differential diagnosis of the meningococcus a matter of considerable difficulty, which can only be decided upon when all the cultural and biological tests are taken into consideration.

In the short discussion which followed no very striking new facts were brought out, but Buchanan (Glasgow) gave an interesting account of the isolation of the meningococcus from contact cases of cerebro-spinal meningitis.

(*To be continued.*)

"HEART DISEASE AND THE SERVICE." SOME FURTHER REMARKS.

By Lieutenant-Colonel R. C. COTTELL,
Royal Army Medical Corps.

Lieutenant-Colonel R. R. H. Moore, in his criticism, in the February, 1908, number of the Journal, of my report on "Heart Disease and the Service," printed in the November, 1907, issue, accuses me of drawing conclusions from my examination of the after-histories of many of the men that were invalided from the Service during the years 1895 to 1901 inclusive, with a want of "discretion or discrimination," and of casting grave discredit on all the officers of the Royal Army Medical Corps.

I am glad of Colonel Moore's article for two reasons: firstly, because I am pleased to see the Journal a means of eliciting opinions of others; and secondly, because I am given an opportunity of explaining further some points in my report which were very sparingly touched upon.

I think that Colonel Moore, when he states that "it would have been better. . . . if the number of cases taken from the 'Conditional list' had been the same in all the tables allotted to their class," does not understand that, as far as possible, I took every case primarily placed on the "Conditional list," passing over none unless obliged to do so, because of the absence from the man's documents of some point applying to that particular table. The fact is, I wanted all the cases from the "Conditional list" for ten years, and not only 1,280, the total for seven years. Unfortunately, at the end of the seven years, I found I had to bring my labour of collecting and tabulating cases from masses of other documents of invalids to a close. In thinking of headings under which to classify my cases in the tables, I decided on those given, as helping as far as possible to explain, to those who could not see the actual documents, the statements of the medical officers on the condition of the heart, or heart and general health combined, as recorded by them. I gave the terms "improved" and "apparently quite well," not, as suggested, to introduce "elastic terms," but to show that in one case there was a marked improvement, and in the other that it was definitely stated that no heart lesion or other disability could be found. The terms "fit" or "unfit" for duty were, I thought, not so satisfactory; as, for instance, all the

cases under "improved" would have had to be classed as "unfit," which would not have described the condition of most of them at all correctly.

My critic's reference to my remarks which he quotes (1), (2) and (3), p. 145, do not, I think, require his explanation; my tables speak for their correctness. I do not think either that there is any reason for him to suggest "the Reserve of course" in reference to my statement that 26 per cent. were fit for duty at home one year after invaliding; this was not my meaning, and I had not mentioned "the Reserve."

He gives as his opinion that 9·9 per cent. is the utmost I can claim on my tables as fit for duty in from one to six years after invaliding. I do not agree with this, and consider that I was quite within the mark, as shown in Table X., that the percentages of 26·2 for mitral systolic cases, and 18·2 for all cases of "V.D.H.," are, for the years in question, fair estimates of those fit for duty by the end of even the first year after invaliding. I would here point out that Table X. merely deals with 917 "V.D.H." "Conditional" cases, though in the seven years there were 3,424 cases of "V.D.H." Had I had the larger number, composed chiefly of men of little service, my argument of loss to the State (possibly by faulty recruiting or training) would have been strengthened.

His statement that "no one would concede him [myself] more than the number found 'apparently quite well' at the end of the first year" is not, I think, a fact. I feel sure that many medical officers will agree that a much larger number than 3·7 per cent. (Colonel Moore's figures) of invalids for "V.D.H.," even if only judged by those taken from the "Conditional list," are fit for duty at home at the end of a year after invaliding.

With regard to Table VII., "D.A.H.," I certainly added those "improved" to those "apparently quite well," but I did not omit the cases "apparently quite well" at the end of two years, as they could easily have come under the heading of "improved" at the end of their first year, and as far as I could judge were fit for duty then, though not certified as "quite well." If my critic were to see some of the invalids for "D.A.H." that come before us at Chelsea, desirous of getting their pensions extended, and who not only look well, but are doing well on heavy labouring work, he would, I think, be much more likely to agree with me as to the fitness for duty of many of them. In my statement that two-fifths of these "D.A.H." cases were fit for duty two years after invaliding, it was my intention to show that these cases tend to improve

steadily, and that therefore very little risk is run by the State retaining them in the Army. I quite agree with Colonel Moore's statement that the results in Tables VII. and VIII. show "careful and efficient" invaliding taken as a whole, but I contend that in the years under consideration there was a margin in which greater care had been needed, and that that margin of error plus the other factors mentioned in my "Summary" would, if eliminated, have been a source of much saving to the State.

In reference to Colonel Moore's remarks on Table III. as to my not showing the difference of the 933 (Table VIII.) and 819 (Table III.), viz., 114 "V.D.H." cases, I partly explained this omission in my note on Table III., but in addition there was another cause, namely, that in many of these cases I could not trace from what station the men had been invalided. If I had added the cases that had been doing duty and yet were known by the medical authorities to have had more than one admission to hospital for "V.D.H." (some cases having done a large part of their service under these conditions), I should not have added to the truths that can be learnt from Table III. I may say, however, that these latter cases rather help my contention that slight "V.D.H." is not incompatible with the performance of a soldier's duty, though I do not advocate the retention of these cases in any enervating climate. I still think that it is worthy of notice that 19·6 per cent. (Indian), 40·7 per cent. (Colonial), and 40·3 per cent. (Home) invalids were discharged the Service, having had under two months' total medical observation. My critic does not think the figure 19·6 per cent. invalided from India under two months' total observation is worthy of notice, because all classes of "V.D.H." are included in this number, the grave, the more doubtful, and the mild cases. Perhaps I have laid too much stress on this figure, but I do not think so.

With regard to his calculation showing that the remaining 140 invalids from India, after deducting the 19·6 per cent. from the total 174, were on an average 5·6 months under medical observation, I quite see his point of view, but I still think the time allowed was too short. Colonel Moore, it must be remembered, only wishes to retain in the Army at home men who are absolutely free from "V.D.H." or "D.A.H." He says further on, "I cannot understand such a point being made of the necessity for a long period of observation at home of men who have already undergone a long period of observation abroad." This, and other remarks that follow, do not quite apply to my contention, as I said the "total" observation time (abroad, on the ship, and at home) was

too short; however, it was my intention to show that the time allowed at home was insufficient. I was pleading for a longer time in all cases to enable us to do away with all possible errors of diagnosis, and also so that the "stationary condition of the heart after the man had been given every opportunity of recovering his general health" might be more definitely known. I consider that a total observation of nine months for men from India, and six months for men from most of the colonies or serving at home, would not be excessive, discretion being of course used as to the class of case. Of the home invalids for "D.A.H.," 154 out of 238 had been under observation from one to two months, and 238 out of 591 home invalids for "V.D.H." were also invalided under two months' total observation. I should further like to point out that my figures are not drawn from the total invalids for the seven years (5,144), but from only 1,150 of them.

We are told that cases "apparently quite well" one year after invaliding "would never be passed as fit for active service." I do not know how this point can be argued, and can only state that the medical opinions given by our own officers on the men's documents, in the cases put by me under this heading, definitely stated that these men were free from cardiac trouble, and suffered no disability as to their capacity for work in the general labour market.

I am glad that Colonel Moore feels that he can state that cases with doubtful mitral systolic organic bruits are not nowadays hastily invalided, and that they form the greater part of the cases sent home for "V.D.H.," and discharged to duty at home, and that he can quote figures from the Army Medical Reports for 1903 and 1904 to substantiate his statements. I, however, cannot consider that I was wanting in "discretion or discrimination" when I stated that I thought there had been, during the years 1895 to 1901, undue hurry when invaliding for both "V.D.H." and "D.A.H." He does not agree with me that men with mild mitral stenosis and mild "D.A.H." should be allowed to serve on in the Army at home; well! we cannot all think alike, and he may, of course, be voicing the opinion of the majority of the officers of our Corps, but I cannot think so. He is, I think, unfair to me in his remarks where he tries to show that I contradict myself as to the life a soldier leads when out of the Service, and its effect on him. It is incorrect to imply that I wish to retain any cases of serious heart lesion in the Service, those, namely, that we all know would do badly; but taking into consideration the work many pensioned soldiers, who are suffering from mild cardiac affections, are doing, with no

apparent damage to themselves, I certainly am led to think that a soldier's duties and life would be very much less trying, and that these men would, consequently, have been able to serve on and so save the country their pension expenses. My remarks as to the early improvement of these mild cases of "V.D.H." and "D.A.H." after invaliding, that I am told tell against me, merely, I think, point out that these cases do improve early after invaliding, not that they would do badly had they remained in the Service.

With regard to Colonel Moore's statement that I have cast "grave discredit" on all the officers of the Royal Army Medical Corps by my remarks on recruiting, training, and invaliding of cases for heart affections during the years under observation, I may say I feel quite sure that he must stand alone in this opinion. I examined a great many documents and found almost invariably the same diagnosis given year after year by different medical officers and medical boards; the exceptions being, apparently, chiefly in those cases wrongly diagnosed, owing, I thought, to too little time having been allowed for their observation. I stated that I thought that the recruiting was not sufficiently followed up, so as to eliminate as far as possible all weaklings in the first three months; this is now practically done. With regard to my remarks on training, surely my statements could not be regarded as aimed against our Corps, as I expressly said that I thought all physical training should be more directly under our supervision.

Those of us who had the advantage of hearing the views of Dr. Pembrey in his paper read at the meeting of the United Services Medical Society on February 13th last, on the "Physiological Principles of Physical Training," and at the same time of hearing what the heads of the training branches of the Navy and Army had to say in defence of the old and also of the present (more or less Swedish) systems of training, will have been struck by the convincing arguments against all systems of exercises that are not based on a gradual building up of the body to meet its actually known special physical needs, varying naturally as to these needs with the different branches of either Service which the men may be intended to join. The representatives of the Navy and Army agreed in condemning the old system, and stated that the present system was a distinct advance, but that it was on its trial. It was shown that in the Navy the method of training the young lads had greatly improved since 1898, and this appeared to be the case too in the Army, but not to the same extent, it being naturally much more

difficult to train men in a few months than to train boys in a period lasting over several years. I am quoting the above opinions to prove that it was and is admitted that the training of the recruits afterwards invalided during the years 1895 to 1901 was defective; but this was not due to any special faults in the officers of our Corps.

I hope I have shown by the foregoing remarks that I was blaming the system of recruiting that did not follow up weedy lads during the three months after their enlistment; the system that neglected the rational training of the recruit and young soldier; and the system that hurried a man out of the Service directly some slight lesion or other affection of the heart had been detected. To my mind too much weight was given to these mild deviations from the normal, and their effect on the soldier, especially if he were only required to serve at home. Perhaps in my report I laid too much stress on these points as being even now not sufficiently taken into consideration. I must admit that the present system of recruiting is vastly superior to the old, and we have Colonel Moore's statement that there is no hurrying of men out of the Service now; but the question of keeping in the Service men having slight cardiac disabilities is still one that is, I think, worthy of consideration, and I wish to lay whatever weight my opinion may have on the side of keeping these cases in the Army for duty at home.

THE PREVENTION OF MALARIA IN BRITISH POSSESSIONS, EGYPT, AND PARTS OF AMERICA.[1]

(Report to Section VII. of the Fourteenth International Congress of Hygiene and Demography held in Berlin, September, 1907.)

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(*Continued from p.* 170.)

V.—Campaign at Hong Kong.

One of the earliest and best of the campaigns in British territory. The city of Victoria, usually called Hong Kong, runs for nearly 5 miles along the north of the island of that name at the mouth of the Canton river in South-east China. The island, 11 miles long, and from 2 to 5 miles broad, consists of a broken ridge of hills, rising to nearly 2,000 feet, and the city is built on a hill sloping down to the water, some of the terraces and houses being 500 feet above sea level. There is also a large residential district on the mountains reached by a cable tramway. The soil is granitic. All along the face of the hill on which Victoria is built there are beds of streams, known as "nullahs," which used to swarm with anopheline larvæ.' The population of the colony was 377,850 in 1905, of which 10,835 were whites (nearly half belonging to the British Army and Navy). The rainfall is from 70 to 80 inches a year. Malaria has always been very prevalent here, and I remember that in 1881 the colony was cited as an example of the telluric miasma due to decaying granite. The first researches on the new lines were commenced as early as May, 1901, by Dr. J. C. Thomson,[2] who undertook an exhaustive study of the mosquitoes and their breeding-places. He examined over 32,000 specimens, of which he found about 4 per cent. to be anophelines, and in November advised an active anti-malaria campaign by drainage, clearing of jungle, "training" of the nullahs, the use of wire gauze, oiling pools, and quinine prophylaxis. As seen by his excellent papers,[3] his recommendations were not of a general nature, but

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[1] Also printed in the *Lancet*, September 28th, 1907.

[2] Thomson, "The Distribution of Anopheles and Culex at Hong Kong," *British Medical Journal*, 1901, vol. i., pp. 749 and 1379.

[3] *Ibid*, "Malaria Prevention in Hong-Kong." Official report, containing many letters, 1900-1903.

were particular, practical, and exact. These recommendations were rapidly acted upon by the Government. Since 1901 all the nullahs or water-courses within and near the city were "trained"—that is, rendered so smooth and even that the anophelines could no longer breed in them; and much similar work was done wherever most needed elsewhere by "training" water-courses, buying up rice fields, and so on. The details of the campaign are so numerous that it is impossible to give them here. They will be found in the publications given in the bibliography, and in a good paper by Mr. J. M. Young,[1] who took part in the early stages of the work. The results are given in the annual sanitary reports of the colony and in a recent address by the medical officer of health, Dr. W. Francis Clark.[2] Dr. Thomson informs me that before estimating them, it is necessary to remember that malaria can never become extinct in Hong Kong, owing to the fact that some 3,000 to 4,000 natives come and go from and to the country districts every day, and that a number of these will remain infected in spite of all local measures. Nevertheless the figures show a rapid diminution both in the admission- and in the death- rates.

Malarial Districts of Two Large Hospitals.

	Years								
	1897	1898	1899	1900	1901	1902	1903	1904	1905
Admissions	1,021	865	780	1,220	1,294	752	568	433	419
Deaths	197	126	63	163	132	128	63	58	54

Admission-Rate of Police for Malaria.

	Years									
	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
Admission per cent.	32	25	19	31	42	44	19	18	11	12

Deaths from Malaria.

	Years									
	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
Population ..	239,419	—	—	—	—	—	—	—	—	377,850
Total deaths ..	533	554	530	546	555	574	425	300	301	285
Deaths in city (Chinese only)	290	302	280	218	242	281	189	152	90	87

The official sanitary reports give similar figures. The improvements have, of course, varied much in different localities. Thus in 1900 the western end of Bonham Road used to be one of the worst

[1] Young, "The Prevention of Malaria at Hong Kong," *British Medical Journal*, 1901, vol. ii., p. 683.

[2] Clark, "An Address on the Prevention of Malaria in Hong Kong." Noronha and Co., Hong Kong, 1906.

districts. Now in 1905 it is reported not to have sent a single case to the Government Civil Hospital.[1]

With regard to cost, Dr. Clark reports that up to the end of 1905 the Government had expended about £5,000 on anti-malaria measures, and estimates that £6,500 would be spent by the end of 1906—a small amount to pay for the good that has been done. The campaign in such a thickly populated district must be difficult. A larger expenditure would probably have produced still more marked results, and it would have been useful to estimate the endemic index in various parts of the area. I am much indebted to Dr. Thomson and also to Mr. J. Bell for the detailed information which they have been so kind as to send me, but which I have no space to give more fully.

VI.—Campaigns in India.

In 1898 I had hoped that India would have led the way in the matter of malaria prevention. Long previously the Government had done very well by issuing cheap quinine in malarious localities, and by making several local enquiries. The disease existed more or less throughout the country, and in some military stations caused an admission-rate of several thousands per mille, while in other places it was an extremely serious detriment to development. There were numbers of places as dry and easy to deal with as Ismailia; while few presented worse difficulties than the towns in the Malay States. The military stations were under the complete control of the authorities, and experienced administrators, sanitary officers, and engineers abounded everywhere. So far as I can ascertain, however, little or nothing was done for several years. The first active campaign seems to have been inaugurated in 1902, as an experiment, at Mian Mir in the Punjab, but was most unfortunately a failure, at least at first.

Mian Mir.—This is a large cantonment or garrison town situated on the flat and hot plains near Lahore. Constructed in 1851-52 in the midst of what was then an arid and treeless desert, it was later well watered by irrigation canals. The result was that malaria began to prevail to such an extent that in 1879 the annual admission-rate for fevers rose to 3,427 per 1,000 of the troops, and the place was called "the white man's grave." In 1901, however, Dr. Stephens and Captain Christophers, of the Malaria Commission

[1] Reports on the Health and Sanitary Condition of the Colony of Hong Kong, 1900-1905, p. 54.

of the Royal Society, were sent on my suggestion to India, and investigated the mosquitoes of Mian Mir, amongst other places.[1] In April, 1902, practical operations were commenced, evidently on the Sierra Leone model, by Captain S. P. James, I.M.S., and afterwards by Captain S. R. Christophers, I.M.S. The results, however, were not only negative, but were stated in such a way by these observers as to suggest that mosquito reduction was generally a difficult if not impossible task.[2] The writers had evidently failed to grasp the subject, for they attempted an important work without adequate expenditure, and made other mistakes. Their reports were exhaustively criticised by Giles,[3] Sewell, and myself,[4] but they nevertheless retarded Indian anti-malarial efforts for some time.

Since then, to judge from accounts in the Indian sanitary reports,[5] and from details very kindly furnished to me by Surgeon-General A. Scott Reid, I.M.S., and Lieutenant-Colonel H. D. Rowan, R.A.M.C., wider measures have been attended with better results. Since 1905 the following measures have been adopted. The principal irrigation canal and its branches were closed within a radius of about 800 yards of the barracks and officers' quarters. The surface of the ground was everywhere levelled and the drainage improved, so that even after a heavy fall of rain, not a single collection of water will be found after seventy-two hours (except a large pit which is in course of being filled in). The whole cantonment was divided into six areas, each under a medical officer, and each area is visited once a week by a strong "mosquito brigade." All wells are protected, and those used for irrigation purposes are oiled once a week. Quinine is administered twice a week, on consecutive days, from June to November, under medical supervision. Residents are held strictly responsible for the condition of their compounds (gardens). No undergrowth or rubbish is allowed, nor pits for the reception of sullage water; and other general sanitary improvements have been made.

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[1] Stephens and Christophers and James, "Reports to the Malarial Committee," Royal Society, 7th and 8th Series, 1902, 1903. Harrison and Sons, London.

[2] James and Christophers, "Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India." First and Second Reports of the Anti-Malarial Operations at Mian Mir, No. 6, 1903, and No. 9, 1904.

[3] Giles, "Cold Weather Mosquito Notes from India," *Journal of Tropical Medicine*, April 1st, 1904.

[4] Ross and Sewell, *British Medical Journal*, September 17th, 1904.

[5] Annual Report of the Sanitary Commission with the Government of India, 1905. Calcutta.

In estimating the results Colonel Rowan remarks that the statistics of mortality in the civil population cannot be relied upon, and that there are difficulties in connection even with those of the troops. Since 1905 cases have been returned as malaria only when a microscopic diagnosis has been made, and are otherwise given under the heading of "simple continued fever" (exclusive, of course, of typhoid or undulent fever); but he remarks that this is not quite fair amongst men who are getting quinine with such regularity. He thinks it best to take the admission-rates for malaria and simple continued fever together, and these show a considerable decline. For the five years 1898-1902, the average annual admission-rate per 1,000 of the British (white) troops was about 900. In 1903 it was nearly 1,100; but in 1904, 1905, and 1906 it fell to about 600, 400, and 460 respectively. The general admission-rates for all disease among these troops were 1,950 in 1898-1902, 1,800 in 1903, 1,350 in 1904, 1,350 in 1905, 1,240 in 1906. In a native cavalry regiment which has remained in Mian Mir for the whole of 1904, 1905, and 1906, the admission-rates for malaria per 1,000 have been 242, 108, and 43 respectively. On the whole, he is satisfied with the success of the campaign, but thinks it too early to form an estimate of the full extent of the gains. I am told also that the fact that the troops have to serve frequently at Fort Lahore, a very unhealthy place, does much to distort the figures. But the measures are reported ([1], p. 231) to "have undoubtedly contributed to the decreased prevalence of anopheline mosquitoes and their larvæ during the year." Colonel Rowan tells me that culex are much less common and that anophelines "have become positively rare," although a native is specially employed to find them if possible.

Progress of Events.—In January, 1902, a conference of medical men on the subject of malaria was held at Nagpur. It drew up an excellent set of rules for anti-malarial sanitation, but so far as I can gather, no general orders were issued to make the rules compulsory. Gradually, however, several stations began to adopt measures on a small scale, chiefly, I think, owing to the initiative of individual medical officers, though the results at Mian Mir were frequently used to discourage them. Apart from practical work numerous good articles on mosquitoes and their habits appeared.[2] [3] It is difficult to give any adequate account

[1] Colonial Reports, Annual. Wyman and Sons, London.

[2] *Indian Medical Gazette*, January, 1905, p. 30.

[3] James and Liston: "A Monograph of the Anopheles Mosquitoes of India." Thacker, Spink and Co., Calcutta, 1904.

of the campaigns because the full facts are not obtainable, but I will refer briefly to the following.

Major W. J. Buchanan, I.M.S., Inspector-General of Prisons in Bengal, has been good enough to give me some details of his campaign at Buxor Central Gaol. Buxor, in Bengal, is full of malaria, attributed to the large number of small irrigation canals. The gaol is a good one, well situated and drained, but it has one irrigation canal entering it in order to supply water. In June, 1904, Major Buchanan had the canal banks close cut, cleared and tarred, and gave similar treatment to certain tanks. All pools, puddles, and hollows were filled up, and land in a neighbouring village was acquired for the purpose, while quinine was given every Saturday and Sunday during the malaria season. The results among the prisoners (averaging about 1,400) were:—

	Years				
	1902	1903	1904	1905	1906
Admissions for malaria.. ..	2,091	2,455	1,267	1,207	1,191

It should be remembered that prisoners are constantly being changed, new and infected criminals being frequently introduced from outside. Major Buchanan adds that he is adopting similar measures in all gaols. It is difficult to find mosquito larvæ in any of the better situated ones. He approves of quinine prophylaxis in addition.

In the Madras Presidency, Colonel W. G. King, I.M.S., the Sanitary Commissioner, took early interest in anti-malaria work and commenced to organise mosquito brigades; and in 1904 the Government was reported to have taken active steps in this direction. It accepted Colonel King's scheme, suggested a suitable organisation, and advised municipal councils to meet the expenditure required.[1] I have not yet seen any description of the results.

Captain C. A. Sprawson, I.M.S., has been kind enough to give me many details of the work at Jhansi, a town of 12,457 inhabitants in Bundelkand. Operations appear to have been started at the beginning of the rains in 1906. The cantonment was divided into two areas, one for the white troops and one for the native troops, each division being placed under the appropriate medical officers under whom mosquito brigades were appointed. The native quarter was also looked after. Instruction regarding malaria was made public. The money allotted for the actual work, however, appears to have been rather small, as it was not

[1] *Indian Medical Gazette*, January, 1905, p. 30.

allowed to exceed about £23 a year—less than ½d. per head of population and 2d. per acre of land. As a matter of fact, the admission-rate for malaria seems to have increased rather than diminished, for it was 246·5 per cent. in 1906 against only 71·8 per cent. in 1905. The surrounding villages appear to have been left untreated, and the cantonment itself is full of borrow-pits.

Although campaigns seem to have been at least commenced in many stations in India, I can gather only meagre and insufficient information about them in the official reports. At Jubbulpore and Dinapore considerable drainage and anti-mosquito works, combined with quinine prophylaxis, appear to have produced marked effects ([1], p. 16). Active, and so far as I can ascertain ([2], p. 230) enthusiastic, measures have been adopted at Peshawar, Rawal Pindi, Sialkot, Ferozepore, Karachi, Mhow, Kamptee, Deesa, and Saugor; and in Burma ([3], p. 6), at Akyab, Myitkyina, Monywa, Paletwa, Mogok, Kyaukpyu, and Maymyo. At Mogok Captain J. Good, I.M.S., reports a diminution of malarial fevers (diagnosed by the microscope) from 25·4 per cent. of admissions in 1905 to 16·4 in 1906. As a rule, however, neither results nor expenses are given in the official reports.

The total amount of malarial fever in India, with its population of about 300,000,000, is immense. There must be several millions of deaths directly or indirectly due to it every year. Among the troops and prisoners in gaols the annual number of admissions into hospital for malaria equal between a quarter and a half of the total strength. It is therefore very necessary that all the anti-malarial work throughout the country should be dealt with in a business-like manner, and that the results obtained should be collected and published for guidance and study.

VII.—Other Campaigns.

Khartoum.—This very interesting work was commenced in 1903 by Dr. Andrew Balfour, Director of the Wellcome Research Laboratories of the Gordon Memorial College, and will be found accurately described in the two fine reports of the laboratories,[3] to which I must refer for details. After a preliminary survey of

[1] Annual Report of the Sanitary Commissioner with the Government of India, 1905. Calcutta.

[2] "Colonial Reports," Annual. Wyman and Sons, London.

[3] Balfour, First and Second Reports of the Wellcome Research Laboratories, 1904 and 1906. Department of Education, Khartoum.

the local mosquitoes, a small brigade was started on the lines laid down by me, and quickly attacked the breeding places. These in Khartoum were wells, pits, garden tanks and pools, sullage pits, river pools, and collections of water in steamers and barges. After heavy rain large pools which may last for some time form on the flat ground and used to breed many mosquitoes. All these waters were attacked by various methods, with the result that the larvæ were found in quickly decreasing numbers. Now, in his second report, Dr. Balfour remarks that, although mosquitoes have not been completely banished, yet "we are rid, and well rid, of the annoying stegomyia, the dangerous pyretophorus is kept in abeyance, and culex, the ubiquitous, has ceased to be a nuisance." He adds: "I have not seen a living, wild, adult anopheline in Khartoum for more than a year and a half, and I am always on the outlook for these insects." The effect on the amount of malaria could not be estimated owing to the absence of statistics and to the fact that malaria was never very prevalent there. If by accident the insects are allowed to recur, malaria reappears; and he tells me that since the date of his second report, six primary cases have been caused in this way, though the outbreak was promptly suppressed. Owing to the assistance of Lieutenant-Colonel R. H. Penton, D.S.O., R.A.M.C., Principal Medical Officer of the Sudan, the work was extended. Surrounding villages are heavily infected, but excellent rules regarding irrigation are being introduced. Dr. Balfour and his colleagues are to be warmly congratulated on their work.

Some years ago Colonel Penton asked me to go to the Sudan to advise regarding the prevention of malaria there. I was unfortunately unable to accept the invitation, but he himself has carried out excellent work with considerable success at Kassala and El Obeid, besides Khartoum.[1] In Port Said (56,000 inhabitants) an active campaign has been conducted by my brother, Mr. E. H. Ross, against the mosquitoes there.[2] The result is, he says in a letter dated last March, that there "has been almost complete absence of the pest in a year's work. No case of acute malaria has been admitted to hospital since August last. There has been a reduction in the death-rate. . . . At Ismailia the

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[1] Penton, "The Malarial Campaign in the Sudan," JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. iv., p. 628, 1905.

[2] E. H. Ross, "Measures against Mosquitoes in Port Said," *Journal of Tropical Medicine*, March 15, 1907.

results are well known. There is now a complete absence of mosquitoes and of malaria. But in some of the villages round there is much malaria and many anophelines, owing to the irrigation." In Cairo, in the district of Kasr-el-du-Barra, and Helowan, campaigns have been organised with success by my brother, Mr. H. C. Ross. This Egyptian work has been carried out with the sanction and approval of Sir Horace H. Pinching, the distinguished head of the Sanitary Department of Egypt.

Candia, Crete.—The accounts of this excellent campaign, conducted in connection with the British troops in Crete, will be found in successive numbers of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS. The town of Candia, containing 21,000 inhabitants, is situated on the seashore of a semicircular plain bounded by hills. The rainfall is heavy and the ground is traversed by many streams which become torrents in winter and nearly dry in summer. Two of them have marshy margins near the sea. The houses of the town are of the Oriental type and contain many wells. The troops are accommodated in quarters to the west of the town and close to it, and suffer considerably from malaria. Apparently as early as 1902,[1] Lieutenant-Colonel J. V. Salvage, R.A.M.C., commenced to examine into the distribution of anophelines and to destroy the larvæ by drainage, or by closing or oiling the wells, or putting fish into them, and expressed himself hopefully regarding the result. In March, 1903, Major (now Lieutenant-Colonel) C. J. Macdonald arrived in Crete and continued the work.[2] He gives many very interesting details. Works of a permanent nature were attempted and quinine prophylaxis and mosquito nets insisted upon. The first results were as below:—

	Years		
	1901	1902	1903
Strength	564	460	410
Admissions	1,540	1,084	227
Rate per cent...	273	236	55

The admissions include simple continued fever, together with malaria, in order to avoid error due to diagnosis. Colonel MacDonald attributes the fall to the measures taken. In 1905 Captain R. A. Cunningham, R.A.M.C., adds a third article,[3] in which he states

[1] Salvage, "Preventive Measures against Malaria in Candia, Crete," JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. vii., p. 566, 1904.

[2] MacDonald, "Crete as a Station," &c., *ibid.*, vol. iv., p. 31, 1905.

[3] Cunningham, "Malaria Fever in Candia," *ibid.*, vol. v., p. 274, 1905.

that the fall in the malaria-rate had continued, and was only 30 per cent. in 1904 compared with the 55 per cent. in 1903. The mosquitoes were so few that it was almost unnecessary to use a net at night. In 1905 ([1], p. 103) there were 246 admissions, or a rate of 38·7 per cent. Many men become infected on guard and outposts.

St. Lucia.—A good account of this work has been given by Lieutenant-Colonel F. P. Nichols, R.A.M.C.[2] British troops have long been stationed at Castries, St. Lucia. During 1902 and 1903 drainage works were carried out by Colonel Hodder, of the Royal Engineers, but shortly afterwards the garrison was removed. Colonel Nichols has attempted to ascertain the effect of the operations on the health of the troops before they departed. He gives many interesting cases, and remarks: "The apparent effects were very marked, as noted by both officers and men, by Major Bent, R.A.M.C. (to whom I am indebted for many notes on the point), and by the other Royal Army Medical Corps officers, and as testified by the immediate drop in the admission-rate for malarial fevers, which began at once and has continued ever since." Colonel Hodder said: "At the present time (1904), in buildings which were formerly infested with mosquitoes of all kinds, scarcely a sign of one exists; but it has taken two years of continuous work to effect this result." Colonel Nichols gives and discusses many figures, from among which I select the following:—

Years	Admission-rate per cent.	Years	Admission-rate per cent.
1895	339	1901	575
1896	417	1902	851
1897	314	1903	127
1898	256	1904	77
1899	141	1905	45
1900	100		

The admissions include simple continued fever.

VIII.—Campaigns at Havana and Panama.

Havana.—I have already referred to the great discovery of the mode of propagation of yellow fever and the subsequent campaign against that disease started in Havana in February, 1901. The result as regards yellow fever was decisive for several years, and

[1] Colonial Reports, Annual. Wyman and Sons, London.

[2] Nichols, "The Effects of Large Drainage Works on the Prevalence of Malaria," Journal of the Royal Army Medical Corps, vol. viii., p. 343, 1907.

although it reappeared in 1905 and 1906 it was again banished when the United States resumed control of the island last year. As regards malaria the general war against mosquitoes in Havana produced marked effects. Almost immediately after the commencement of the operations in February, 1901, this disease also began to decline, and the diminution has been steadily maintained. The details will be found in the full monthly statistics of the "Board of Health,"[1] but Dr. Charles Finlay, the distinguished originator of the mosquito theory of yellow fever, and head of the Health Department of Cuba, has kindly furnished me with the following figures of the deaths from malaria in Havana for a number of years:—

Years	Deaths (malaria)	Years	Deaths (malaria)	Years	Deaths (malaria)
1880	335	1889	228	1898	1,907
1881	228	1890	170	1899	909
1882	191	1891	203	1900	344
1883	183	1892	202	1901	151
1884	196	1893	240	1902	77
1885	101	1894	201	1903	51
1886	135	1895	206	1904	44
1887	269	1896	450	1905	32
1888	208	1897	811	1906	26

The population of the city is about 250,000. Dr. Finlay tells me that it has been possible to carry out anti-mosquito work outside the city only occasionally when yellow fever or malaria threatened certain localities. On all such occasions a regular anti-mosquito campaign was started and ordered to be continued thereafter. This great work, due to Gorgas, Finlay, and the United States Government, constitutes an epoch in tropical sanitation.

Panama.—Perhaps even more remarkable is the work of the Americans under Colonel Gorgas on the canal zone of the Isthmus of Panama. As is well known, the attempt of the French to cut the canal through the Isthmus was foiled principally by yellow fever and malaria, and I was told that their effort had cost quite 50,000 lives. The Americans took possession of the works early in 1904, at a time when the mode of propagation and of prevention of both diseases was well known, and they wisely determined to commence their labours with sanitation. Colonel Gorgas, assisted by a capable and enthusiastic staff, was put in charge and attacked the work with knowledge and energy. I visited the place at his invitation in the autumn of 1904 and was a witness of the skill

[1] "Informe Mensual Sanitario y Demografico, Habana."

shown in his dispositions. The country is one of the worst to deal with which I have ever seen. Hilly, with a great rainfall, a loose crumbling soil, a luxuriant vegetation, and innumerable small marshes and pools, it was evidently the very stronghold of malaria. Step by step, with the aid of numerous experts and hundreds of workmen, the Americans cleared the forests, drained the pools, and banished the stegomyia. The details and the results will be found in the monthly and annual reports of the work,[1] and in a recent address by Colonel Gorgas.[2] Put briefly, the results are that in 1906 amongst 5,000 white American employees the total death-rate was only 7 per mille, and of this only 3·8 per mille were due to disease. Last April the daily sick-rate of the total force of about 40,000 people was only 17 per mille. Colonel Gorgas says: "Among 6,000 Americans in the employ of the Commission, including some 1,200 American women and children, the families of these employees, we have but little sickness of any kind, and their general appearance is fully as vigorous and robust as that of the same number of people in the United States." These published statements are fully borne out by private communications from individuals living there. Colonel Gorgas adds: "I think the sanitarian can now show that any population coming into the tropics can protect itself against these two diseases (yellow fever and malaria) by measures that are both simple and inexpensive . . . and that again the centres of wealth, civilisation, and population will be in the tropics, as they were in the dawn of man's history. . . ."

In this great work of Colonel Gorgas and his colleagues, I recognise the attainment of that ideal which was set before me when, ten years ago, I found the zygotes of the parasites of malaria in mosquitoes. I regret only that the honour of attaining it has not fallen to my countrymen, as might well have been the case. But we must none the less congratulate the Americans on the splendid achievement with which they have signalised their entry into the lists of the colonising nations of the world.

IX.—Remarks and Conclusions.

Exigencies of space have compelled me to be very brief in my descriptions of the above campaigns. In addition to them good

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[1] "Reports of the Department of Health of the Isthmian Canal Commission, Monthly and Annual. Government Printing Office, Washington.

[2] Gorgas: "Sanitation in the Canal Zone," *Journal of the American Medical Association*, July 6th, 1907.

work has been commenced in the Andaman Islands, Ceylon, South Africa, Southern Rhodesia, British Central Africa, Sapele (West Africa), and Mauritius (which last-named place I hope to visit shortly on behalf of the British Government). Good work has also been done in connection with many mines and railways in West Africa, but at present details regarding most of these campaigns are not available, or are either too meagre or buried in inaccessible local reports. The excellent anti-mosquito work of Doty and of Weeks and others in the United States, and of the French in Corsica and Algeria, is somewhat outside my province. I should have liked to describe the operations in Greece (which I was able to visit last year), but this will be done much better by my distinguished friend, Professor Dr. Savas. For many papers on the prevention of malaria I must refer to the British medical press, especially to the *Lancet*, the *British Medical Journal*, the *Indian Medical Gazette*, the *Journal of Tropical Medicine*, and the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS.

From all the experiences collected and the discussions carried on during these ten years the following general conclusions are now, I think, beginning to emerge:—

(1) For tropical sanitation against both malaria and yellow fever (and probably filariasis) general mosquito reduction is by far the most practical, as it is the most fundamental, method, at least in thickly populated areas. In support of this proposition, originally advanced by Finlay for yellow fever and now by myself for malaria, it suffices to quote the greatest living authority on the prevention of both these diseases—Colonel Gorgas—who for more than six years continuously has been waging successful war against them, not on a small but on a large scale, and not in easy but in the most difficult possible conditions. Regarding yellow fever, he says:[1] "When we left Cuba after the disappearance of yellow fever, we were inclined to think that the results had been obtained principally by the destruction of the infected stegomyia, but further experience at Panama has convinced me that the important element is the destruction of stegomyia generally. I merely mention this as showing how practical work and experience entirely change well-grounded theories." Regarding malaria, after enumerating the various methods of prevention, he says:[2] "By far the most important of these measures is that of destroying the breeding places,

[1] Gorgas, "Sanitation in the Canal Zone," *Journal of the American Medical Association*, July 6th, 1907.

[2] *Ibid.*

and this is successfully done by surface and subsoil drainage." So many people write on this subject without any real practical experience of it, that we shall do well in future if we listen more attentively to such words as these of Colonel Gorgas.

(2) Prophylaxis by quinine, by screens, and by segregation may be attempted, if possible, in addition to the fundamental measure, but, as regards tropical towns, must be looked upon only as adjuvants to it. As a rule, in the tropics general cinchonisation is feasible only for officials, troops, and bodies of workmen; and screening and segregation can seldom be used except for public buildings and the houses of Europeans. All should be advocated, but there is a distinct danger of wasting on the subsidiary measures efforts and funds which might be more usefully spent on the fundamental one, a thing which I have frequently observed to happen. For example, cinchonisation is being much advocated, and quite rightly so, for the troops in India; but at the same time irrigated fields are often permitted to remain in the close vicinity of barracks. Hence, while the number of relapses among the men may be reduced, yet probably just as many as before become infected from the surrounding untreated population, and a false impression of improvement is given. It is constantly forgotten that for the individual quinine is, properly speaking, not a prophylactic at all—it does not exclude infection, but merely extirpates it (in some cases) after it has effected an entry. It is poor policy to substitute a possible extirpation for a certain exclusion. On the other hand, the subsidiary measures become essential where it is not worth while to attempt mosquito reduction, as in the case of camps and of many isolated houses, farms, plantations, &c.

(3) There is no doubt that the mere knowledge of the fact that mosquitoes cause infection is producing a great improvement of the health of educated people in the tropics. This occurs in two ways: first, such people are more careful in the use of nets; and secondly, medical men, without undertaking formal campaigns, do more than formerly to suppress breeding pools close to houses, barracks, &c. There is thus a kind of unconscious prophylaxis beginning to be adopted everywhere. The following figures, which I have collected from the Indian Sanitary Reports,[11] give some evidence of this:—

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[1] "Annual Report of the Sanitary Commissioner with the Government of India, 1905." Calcutta.

Admission-Rates per 1,000 for Malaria in India.

	Years									
	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905
Gaol prisoners ..	292	383	348	350	364	382	375	366	346	336
Native troops	292	363	355	277	335	373	286	256	201	180
White troops	253	420	427	245	321	300	254	247	177	114

These statistics refer to the prisoners and troops of the whole of India, and are, therefore, very reliable. It will be observed that the admissions among the prisoners have not decreased, owing to the fact that these people, drawn from the lowest classes of the population, are constantly being changed in the gaols, so that sanitary improvements as regards malaria in these buildings can produce little effect on their fluctuating population. On the other hand, there appears to be a considerable decrease among the troops, all of whom have medical men in charge of them, while the white troops are provided also with mosquito nets or punkhas. There has been a slight increase in the amount of simple continued fever diagnosed, but not nearly enough to account for the fall in the malaria rate.

(4) But unconscious prophylaxis of this kind will not do everything, and State intervention is necessary if the fullest results are to be obtained. Here two great mistakes have been made.

The first mistake is to suppose that we can educate the general public by means of notices and pamphlets to protect themselves against disease—a mistake constantly made by inexperienced sanitarians. We may reach a few educated people in this way, but, as every practical health officer knows, the masses will not trouble to take the advice. It is ridiculous to suppose, for example, that a large native population will use nets, or take quinine, or destroy mosquitoes, simply because the "doctors" advise them to do so. Even among civilised nations hundreds of thousands reject so simple a precaution as vaccination. In other words, from a sanitary point of view, the general public is a child which must have everything done for it.

The second mistake is to suppose that small local authorities, if left to themselves, will interest themselves greatly in sanitation. A review of the campaigns against malaria which I have discussed will show that all of them are due to the energy and intelligence of single persons. If a locality possesses a governor or a medical man of capacity the campaign is started and is continued as long as he remains there. If not, nothing whatever is done. The truth is simply that local officials are, as a rule, unwilling to take the

necessary trouble. *Secure of their pay and their pensions they easily avoid the obligation by pretending that the work is too difficult or too expensive.* Now the only way to overcome this inertia is to use official compulsion from the higher authorities. But, strange as it may seem, I have not known a single case in which such action has been taken. The local authorities are allowed to go their own way quite uncontrolled, and are not even compelled to collect statistics. At the same time nothing is done to encourage sanitary officials to bestir themselves in this line. I have not heard of a single instance in which anyone who has really done good work against malaria has received official thanks or reward for his pains; while, on the other hand, honours have been given to men who have actually retarded such work. There is often much pretence of action—conferences are held and speeches are made, but the years elapse and—the malaria remains as it was.

Besides local inertia there is another reason why local efforts against the disease are often so limited, and that is the fact that medical men in the smaller colonies do not always possess the knowledge of how to use the colonial resources to the best effect. Ill-advised attempts are made and result only in failure, waste of money, and discouragement of other efforts.

X.—Recommendation.

After consideration, therefore, I can only suggest—what I have fruitlessly suggested many times for many years—that the best way to encourage more vigorous action in the future is to centralise the anti-malarial administration. Each principal government which presides over malarious countries or colonies should appoint a special commissioner to travel from place to place in order (1) to advise local authorities as to the best measures for dealing with malaria in each locality; (2) to report to the head government; and (3) to organise the collection of statistics. Such an appointment is perfectly practicable, and is in fact nothing but the specialisation of the Indian system of Sanitary Commissioners or of the American Marine Medical Service system. It would gather the reins of anti-malarial organisation into one hand; would help the willing authorities and stimulate the unwilling; and would save funds now often wasted on abortive efforts. At present, I think, the inhabitants of many malarious places have reason to make serious complaint of the slackness with which modern discoveries have been followed up, and we can only hope that the next decade will show a more rapid advance in this respect.

ADDENDA.

Since the above was written the colonial reports,[1] for some West African colonies for 1906 have been published and give more detail on sanitary matters than previous reports have afforded. In Sierra Leone the sum of £2,223 was expended on repairs to streets and on laying down concrete surface drains, and a scheme "for devising a proper system of drainage has been approved by the Secretary of State and will be carried out during the current year." The mortality and morbidity returns, as briefly given in the report, show no marked change during recent years. For Bathurst, British Gambia, it is stated that, "Bordered as it is on two sides by large swamps, there must, however, be a great deal of fever endemic in the place, and this it is impossible to prevent, though considerable improvement has been effected by the anti-mosquito sanitation measures which are vigorously prosecuted." In the report for the Gold Coast it is stated that "improvements were carried out at considerable expense in the towns of Cape Coast, Sekondi, and Kumasi." The Deputy Principal Medical Officer states: "I have no hesitation in saying that the health has improved," but I can find little trustworthy evidence of this in such figures as are given in the colonial reports. Work done in Burma has already been mentioned, but further details will be found in Colonel King's report on the sanitary administration of Burma for the year 1906, showing that active interest is now being taken in the matter.

Regarding the Federated Malay States, there was a great increase of malaria during 1906 in the district surrounding Klang and Port Swettenham, owing to a large influx of coolies, but in these towns themselves it has remained absent owing to the measures taken (supplement to the *Selangor Government Gazette*, 1907). Dr. M. Watson is urging energetic measures for dealing with the malaria of coolies in plantations. Great interest is shown in the country regarding the whole subject, and the medical department is happy in having the strong support of the British Resident, Mr. Conway Belfield.

At the meeting of the British Medical Association in July, Major A. H. Nott, I.M.S., described an anti-mosquito campaign at Murshedabad in India, but I regret that I have not yet been able to see a copy of his work.

Owing to the efforts of Colonel Seely, M.P., and Mr. Hahne-

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[1] "Colonial Reports, Annual." Wyman and Sons, London.

mann Stuart, the British Colonial Office promised last year to issue a report on the prevention of malaria in all the colonies in its jurisdiction, but the paper has not yet been published.

As many shipowners have taken interest in tropical medicine, I sent a circular some months ago to most of the leading firms with sailings to the tropics, asking them for information regarding the steps which any of them may have taken to prevent malaria on board their ships. Although the request was repeated, only three firms have replied. The Booth Steamship Company (Liverpool, New York, and Brazil), which has done much for research work, informs me that quinine is given regularly to its crews while on the Amazon, and that the men are provided with mosquito nets and the ships' hospitals with wire-gauze fittings. They have few cases of fever. The Harrison Line (Liverpool, America, South Africa, and India) has never had many cases of fever on board its ships; but nevertheless quinine is given regularly "at malarious ports," and the men are supplied with muslin mosquito-bars. Messrs. John Holt and Co., who charter steamers to various tropical ports, strictly order the use of quinine and provide mosquito nets and sun-helmets for the men. Mr. Holt says that "the general effect of our instructions has been to lessen fever arising from malaria," but is disappointed that it has not been entirely banished. He is not a shipowner, but wishes that some owner would build (experimentally) a steamer fitted for excluding mosquitoes, and cannot conceive that such a thing is impossible to human ingenuity. He thinks that legislation should be passed to compel vessels visiting the tropics to adopt the necessary measures against malaria.

Clinical and other Notes.

THE TRANSMISSION OF PLAGUE BY FLEAS.

By DAVID SOMMERVILLE, B.A., M.D., M.R.C.P., D.P.H.
Public Health Laboratories, King's College, London.

I HAVE read with much interest the able article on Plague, which appeared in this year's January number of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, by Lieutenant-Colonel C. Birt. The argument throughout is excellent, as experiment alone is made the criterion of the truth of each conclusion. One cannot over-estimate the importance of the experimental data which prove that the inoculation of the *Bacillus pestis* is not through accidental abrasions or cuts of the skin, nor through the dust and filth of the floors of plague-houses, nor through the soil, nor by aerial infection, but by the inoculation of the puncture in the skin with dejecta from the flea that produces the puncture.

In view of some work that I have been engaged in at odd moments during the past three years, on the destruction of fleas by disinfectants, it is of interest to me to note that *Pulex irritans*, in addition to *P. cheopis* and *Ceratophyllus fasciatus*, has been shown to carry plague bacilli, and to communicate the disease to animals. Hertzog's observation of *B. pestis* in *Pediculi capitis* is interesting in this connection; as also Colonel Birt's reference to dry dust as an essential to the propagation of fleas, whilst moisture is an essential to their destruction. Fumigation is not nearly so successful in this country as the use of liquid disinfectants in destroying the human flea and the rat-flea; and I take it that in these matters the same results must be obtained in India.

If the author will allow me, I should like to add a line from my laboratory note book to the paragraph towards the end of his article on the prevention of plague. Colonel Birt is correct in stating that ordinary germicides, such as 1 in 1,000 mercuric chloride, 1 in 100 permanganate of potassium, 1 in 40 formalin, &c., are powerless to destroy fleas; but his statement that "an emulsion of phenyl and petrol in 800 parts of water appears to be the method of most practical worth devised up to the present" may now, I think, be amended for the benefit of those practically engaged in the destruction of fleas in plague districts. The following table expresses the germicidal values in terms of the Rideal-Walker co-efficient of three bodies with which I have worked on fleas :—

Cyllin	17·0
Phenyl	2·0
Petrol	1·0

The germicidal values of the following two combinations are :—

50 per cent. cyllin .. .. 50 ,, petrol	10·5
50 per cent. phenyl .. .. 50 ,, petrol	1·5

It is evident that the combination of cyllin and petrol possessing a coefficient of 10·5 is a reliable germicide for plague bacilli; it is at the same time a reliable pulicide.

A FURTHER NOTE ON OPERATIONS UNDER LOCAL ANALGESIA.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

For many years past I have invariably performed the operation of circumcision under a local analgesic. At first I used a 5 per cent. solution of cocaine. Then I found that the procedure could be carried out quite satisfactorily under a 1 per cent. solution. For the last eighteen months I have used eucaine and adrenalin.

In all the cases done under cocaine, and the earlier ones under eucaine, the fluid was introduced at the proposed line of incision through the skin. This incision was invariably quite painless, but the trimming up of the mucous membrane was usually more or less painful, as was also the introduction of the stitches.

I then tried injecting the mucous membrane at its attachment near the corona, and in every case where this was possible the operation could be guaranteed to be absolutely painless. Three or four insertions of the needle were, however, necessary, to do this part of the injection properly. In a considerable number of cases the mucous membrane is enormously thickened, and retraction is impossible. In these I tried, by pushing the needle deeply into the mucous membrane, to flood it with the solution. In a number of cases this manœuvre acted satisfactorily. but there was no absolute certainty about it. Lately I have tried injecting the subcutaneous tissue of the penis as close to the symphysis as possible. The loose tissue is picked up between the finger and thumb, and the needle is inserted at right angles to the long axis of the organ. About 15 cc. of Barker's solution is injected, and by rotating the penis to meet the needle-point, it is possible to inject half its circumference. Not less than 30 cc. should be used altogether. The operation should not be commenced for at least half an hour. Every case I have done by this method has been absolutely painless.

I am quite aware that there is really nothing new in the method I am advocating, for "one is only carrying out the fundamental principle which underlies all local analgesia, produced by the injection of various

drugs, viz., that certain substances applied to the branch of a nerve suspend its sensory functions over its whole distribution for a considerable time (*vide* Barker's paper, vol. ix., p. 115, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS).

The main advantages which seem to exist over the older methods are: (1) The absolute certainty of rendering the *whole* of the skin and mucous membrane analgesic; (2) the possibility of introducing the injection through one needle puncture; (3) the fact that the skin near the symphysis is much less sensitive than that near the end of the organ, especially when there is inflammation present; (4) there is no œdema at the site of operation; (5) there is (thanks to the adrenalin) no hæmorrhage requiring a ligature: the continuous suture and gauze pressure is quite sufficient for this.

The operations for ingrowing toe-nails and for hammer-toe, which I have described in previous volumes of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, can be performed more satisfactorily by introducing the eucaine solution near the web so as to act on the nerve trunks. In the former operation it need only be injected into one side, but in the latter it is necessary to inject both sides of the toe. A comparatively large quantity should be used, and the operation should not be commenced for at least twenty minutes.

Necessity for Drainage.—By making use of catgut sutures to obliterate the deeper parts of operation wounds, such as those of radical cases of hernia or varicocele, one is able to dispense with the drainage which one used to consider necessary in order to get rid of the excessive serous discharge which is poured out when the effects of the adrenalin have passed off.

REPORT ON A CASE OF RUPTURE OF THE KIDNEY AND SPLEEN.

By MAJOR F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

PRIVATE G. was admitted to the Military Hospital, Colchester, at 3 p.m. on December 14th, having been kicked in the left mid-axillary line over the ninth, tenth and eleventh ribs. There was a crescentic bruise, such as would correspond with the print of a horseshoe. He stated that he had not fallen across anything, and there were no other bruises. Although he arrived at the hospital within fifteen minutes of his injury, there were no signs of collapse. His temperature was 97·4° F., pulse 80, full and strong, and his condition did not suggest that he had received any serious injury. There was no sign of internal hæmorrhage, no vomiting, no fulness in the loin, and only slight tenderness on pressure there. There was no evidence of a fracture of

the ribs. I saw him at 6 p.m. He had just passed a good deal of blood by the urethra, and complained of some pain in the left loin, which became aggravated at intervals, and which suggested renal colic caused by passage of clots. There was slight dulness in the left iliac region, and it was thought that possibly his spleen had been slightly torn. His abdomen was rather rigid and he had some tenderness, which was referred chiefly to the epigastrium. There appeared absolutely no indication for operative interference.

December 15th.--He had a good night. Pulse this morning 100; temperature 99·2° F. Vomited (for the first time since his injury) a little milk at 8 a.m. Hæmaturia ceased during the night.

December 16th.—Temperature last night 100° F.; pulse 92. Temperature this morning 97° F.; pulse 118. No vomiting from 8 a.m. yesterday, until 6.30 this morning. He then vomited some bilious fluid twice, and had hiccough. The abdomen was slightly more distended than yesterday and appeared chiefly due to dilated stomach and colon. A large turpentine enema was given, but without result. He vomited again at 11 a.m., 2 p.m., and 3 p.m. From this time his vomiting and hiccough became almost incessant. His abdomen became more distended and his pulse 132. At 5 p.m. it was thought that the peritonitis was probably due to sloughing of the bowel consequent on some injury to the blood supply.

Laparotomy was performed through the left linea semilunaris. Free blood was found in the left half of the abdominal cavity, but not more than about half a pint. There was extravasated blood in the coats of the descending colon. The small intestines were inflamed and much distended, but no gross injury existed. The coils were therefore quickly emptied through small incisions, and the abdomen closed.

December 17th.—He rallied well from the operation, but his pulse continued very rapid. Continuous rectal injection of saline solution was carried out in the early part of the night, but owing to his bowels acting freely, this had to be stopped. About three pints were also given subcutaneously. He vomited a good deal of dark blood before his death, which occurred at 11 a.m.

Post mortem, Twenty-four Hours Afterwards.—No tear in bowel. Extravasation of blood in muscles of left loin, extending down to iliac crest. Much bruising of the great omentum at its attachment to the extreme left of the greater curvature, and the wall of the stomach at this spot was also discoloured. About 6 ounces of blood in the lesser peritoneal cavity. Spleen slightly torn through its posterior edge. Left kidney completely torn across its upper one-third, and surrounded by about 1½ pints of dark blood-clot. Extensive subperitoneal hæmorrhage in all directions. No fracture of rib, and only very slight ecchymosis in two of the lower intercostal spaces. No injury to the diaphragm.

Remarks.—The entire absence of shock after such a severe injury to

one kidney is, I think, remarkable, especially from what one knows of the effect of a "kidney shot" on animals. It is also difficult to understand how the kidney could have been torn at all, without fracture of ribs, from a blow placed as this one was. From the very transitory bruising of the skin, absence of fracture of the rib, and a small amount of ecchymosis in the intercostal spaces, one gathered that the blow could hardly have been given by the animal with its full force.

Mr. A. E. Barker was kind enough to send the following reply to my request for his explanation of the injury to the kidney: "Such cases of injury to the kidney by a blow on the lower ribs are not unknown, even where the ribs are unbroken. I suppose the explanation is, that the ribs are resilient enough to yield to the force applied, and catch the kidney against the spine, so crushing it. I have seen a *post mortem* on such a case, where the wheel of a waggon passed right across the abdomen, over the lower ribs, completely crushing the upper one-third of the right kidney, and bruising the jejunum to such an extent as to cause a bad stricture: the man recovered, and without operation. He lived six years, dying as the result of the stricture of the jejunum. The upper one-third of the right kidney had been completely pulped and was only represented by scar tissue. Such cases offer great difficulties for the surgeon."

Mr. Barker's case is extremely interesting, but is hardly quite a parallel one to the case I have reported above. It would be very interesting to hear if any member of our Corps has ever met with a precisely similar case.

INTRAPERITONEAL HÆMORRHAGE FROM A RUPTURED TUBAL PREGNANCY.

By Captain A. E. WELD.
Royal Army Medical Corps.

That a case of internal hæmorrhage from a ruptured Fallopian tube is not quite an every-day affair, must be my apology for asking you to record this case.

Past History.—Mrs. B. aged 34, had been married fourteen years. She was a multipara, and had had three children. The first child was born one year, the second four years, and the third thirteen years after marriage. She had had no miscarriages. There was trouble after each confinement, especially after the last one, which was followed by some sapræmia, as she stated that "the discharges were offensive, she had attacks of fever, and was in bed for a month in a Dublin hospital." She had never felt well since.

Present Illness.—She had never suspected that she was pregnant, as she had, she maintained, been "unwell" every month since her last confinement, sixteen months before. Close questioning, however, elicited

the facts that the period two months before had been delayed in its onset, and that the one a month previous had also been delayed some days, and only lasted one day, and was accompanied by pain in the left iliac region. Twenty-one days after this so-called period, the pain in the left iliac region suddenly became agonising, and she was admitted into the Military Families' Hospital, Curragh, with the signs and symptoms of severe shock and internal hæmorrhage. A diagnosis of hæmorrhage from a ruptured left Fallopian tube was made, and laparotomy performed as soon as possible.

On opening the peritoneum blood welled out. The pelvis was at once explored, and a ruptured left Fallopian tube found, clamped, ligatured and removed. Handfuls of blood-clot were removed from the pelvis and peritoneum. As the general condition was very bad, 3 to 4 pints of hot saline were left in the peritoneum, and the wound was closed. At the end of the operation the pulse (150) was slightly better than at the beginning. On being taken back to bed 4 pints of saline solution were injected into the submammary tissues, at the rate of a pint in thirty minutes. This improved the pulse wonderfully.

From this time on she made a steady and uninterrupted recovery. The stitches were removed on the eighth day, and the wound having healed by first intention, the patient was, a week after operation, put on full diet, and a month after was able to walk by herself.

I must thank Major F. E. Gunter and Lieutenants A. G. Cummins and M. J. Lochrin, R.A.M.C., for their assistance in the case.

THE INFECTIVITY OF LOBAR PNEUMONIA.

By Lieutenant W. G. AVISS.
Royal Army Medical Corps.

The infectious nature of acute pneumonia was well recognised before anything was known of its bacteriology, and there are many records of severe epidemics in large towns, of outbreaks in jails and barracks, which point conclusively to its infectivity. As a rule, however, the source of infection cannot be traced in individual cases. It is, I believe, the rule rather than the exception to treat cases of pneumonia in general wards in hospitals, wards occupied by many patients suffering from other disorders. And yet how very rarely this apparently risky procedure is followed by any evil consequences! We cannot, however, always rely on the immunity of those in proximity to the patient, as the following facts which recently came under my own observation show:—

The family P. occupied a kitchen and two bedrooms, opening into one another on a ground floor. The family consisted of eight persons, viz., father, mother, and six children. They were apparently in good health. There was no pneumonia in the neighbourhood.

(1) On December 10th William, aged 11, was seized with pain in the right side, and when seen shortly after was apparently suffering from pneumonia, the respirations being hurried (40 per minute), pulse 120, and temperature 105·2° F. Later he developed typical signs of consolidation at the right base, and on December 17th (eighth day of disease) the temperature fell by crisis. (2) On the next day, viz., December 18th, Edward, aged 2, was taken suddenly ill with vomiting. Seen shortly after, the respirations were 64, and the temperature 104·2° F. He developed signs of broncho-pneumonia, and the temperature fell by crisis on December 26th to 27th (tenth day of disease). (3) Two days after Edward was attacked, viz., December 20th, the father, aged 36, and a son Leonard, aged 4, were taken suddenly ill, both with severe pain in the right side. In the father the temperature was 104·5° F., the respirations 56, and there were signs of pneumonia in the right lung. The temperature fell by lysis, complete on December 30th (tenth day of disease). (4) In the boy Leonard the respirations were 60, and the temperature 103° F.; this fell by crisis on December 30th (tenth day of disease). In him the disease was located in the right upper lobe.

The sputum was examined only in the case of the father, and contained the pneumococcus in abundance. In each of the last three cases the disease terminated on the tenth day—suggesting that one variety of pneumococcus was at work. With regard to the severity of the infection, the only patient to cause anxiety was the father, who at one time appeared unlikely to recover.

A CASE OF TUBERCULAR SACTO-SALPINX TREATED BY SALPINGECTOMY.

By Lieutenant J. F. C. MACKENZIE.
Royal Army Medical Corps.

It does not, as a rule, fall to the lot of the Army surgeon to have to deal with cases of this nature, and as this particular case was of extreme interest from the difficulty in diagnosis, I think it is worth while reporting.

Mrs. W., aged 23, had been married two years, no children. She was first seen by me at her husband's request, after having been ill for some time. She had been sent to the hills to recuperate, and had improved somewhat after coming up, but had again become ill after a game of badminton and a night's dancing. In view of the condition found at operation, it seems extraordinary that she could have done either. When seen, however, she complained of frequent and painful micturition, accompanied by constant pain in the bladder region. No history of tubercle in the family. On examination: temperature 99° F., pulse 100, tongue coated but moist, urine 1015, neutral reaction, no albumin,

no pus, no blood. She complained of tenderness on pressure in the hypogastric region rather to the right side. *Per vaginam*, a thickened mass could be felt in the right fornix, and pressure here caused considerable pain. In Douglas' pouch, posteriorily and to the right of the cervix, a thickening like scar tissue could be felt superficially, and this thickening was continuous with a thickened indefinite mass that could be felt in the region of the right broad ligament. Any attempt at defining this mass caused intense pain. On the left side there appeared to be some fulness, but no definite thickened mass could be felt as on the right side. There was no tenderness on the left side. There was a yellowish purulent vaginal discharge, which had been present in varying quantity for months.

History of the Case.—Some months before, during the cold weather and while in camp with her husband, she had got a chill, and after this began to notice abdominal pain and swelling. No great notice was taken of this as it was considered by the patient to indicate the onset of pregnancy, which was not unhoped for, in spite of the fact that there had been no cessation of menses; in fact there had been one irregular period. The pain gradually became unendurable, and the swelling became so noticeable that medical advice was sought. A civil surgeon in the plains was consulted, and diagnosed a cystic condition on the right side, advising immediate operation. This suggestion was not quite acceptable, and another opinion was sought. The second opinion was that there was no sign of any tumour or cyst, and that operation was not necessary. Change of air, douches, and a fair amount of rest were ordered. Hence the change to the hills. A month after this the patient was first seen by me as described above.

There undoubtedly had been a tumour. How could this have disappeared? It was certainly not a physiological tumour. The history placed it in the right broad ligament. The onset of the illness suggested an inflammatory condition and not a vascular one. Its disappearance between two examinations was most interesting. One could only surmise that there had been a collection of something which had found its way out somewhere, and the thickened scar-like nodule in Douglas' pouch seemed to indicate the point of exit. However, the patient had never noticed any great or sudden increase in the amount of the vaginal discharge, which had been present from the first. Nothing unusual had been passed *per rectum*. A diagnosis of pyo-salpinx was made, and as the patient was not improving and chronic invalidism seemed threatening, an operation was advised, and in this advice Colonel Pratt, I.M.S., and Major L. Way, R.A.M.C., who kindly saw the case in consultation, concurred.

Operation.—Under chloroform, administered by Major Way, R.A.M.C., curettage of the uterus was first performed, and the abdomen was then opened in the mid-line below the umbilicus. The first glance at the

opened peritoneal cavity revealed the cause of all the trouble, viz., tubercle. The peritoneum, as far as could be seen, was studded with greyish tubercles. The great omentum was adherent to the anterior abdominal wall, and had to be ligatured off and divided before the pelvis could be explored. Large flat gauze pads were inserted to keep the intestines back out of the way, and the pelvis was examined. Two huge distended tubes were discovered. These tubes were narrowed at their uterine ends and seemed to be absolutely shut off from the uterine cavity. The right tube and ovary were buried in adhesions, the left floating free and feeling like a coil of bowel. This was the reason of its not being recognised by external examination. What had happened was clear. The right tube, after dilating to an enormous size, must have burst between the time of the two examinations by the medical men who saw the case. Hence the difference in the advice given. With great difficulty the right tube and ovary were separated from the adhesions, the vessels ligatured with silk, and tube and ovary removed. The same was done with less trouble on the left side. Thus the tubes and ovaries were removed on both sides. The distended tubes, which were as tense as full *massacks*, had to be treated very gently for fear of bursting them. The uterus, which was also thickly studded with tubercles, was left alone, as the primary foci seemed to be the tubes. The original infection may have been from the uterus, but it did not seem advisable to remove it, as the tubes seemed to be sealed off from the uterine cavity. I also removed the ovaries as these were glued to the fimbriated extremities of the tubes, and almost certainly badly infected. The wound in the abdomen was now closed by means of through-and-through silkworm-gut sutures and a few superficial horse-hair sutures. A small gauze drain was kept in the lower angle of the wound. This drain was removed in forty-eight hours.

After treatment.—Saline, ℥x., with brandy, ℥ss., was injected *per rectum* four hourly for twenty-four hours, and six hourly for the next twenty-four hours. To the first two injections tinct. opii, ♏xxv., were added. The progress of the case from now on was uneventful. Horse-hair sutures removed on sixth day and deep sutures on the tenth day. Patient up on the seventeenth day, feeling well. Six weeks after operation patient had put on weight. She had no evening temperature after the operation, though this had been noted previously. Patient looked and felt exceedingly well. Abdominal examination revealed no thickening and no swelling. Vaginal discharge, which was blood-stained for a week after operation, subsequently ceased entirely. There were no signs of tubercle elsewhere. The size of the tubes may be estimated, as the larger one (the left) just found room to go into the neck of a fruit jar, *i.e.*, a diameter of nearly 2 inches. The right one before it burst must have been enormous.

Treves states in his "System of Surgery," that 20 per cent. cases of

tubercular peritonitis recover after opening the abdomen. The results of operation in this case seem very satisfactory, and a fair prognosis may be made for the future.

THE TREATMENT OF TAPEWORM.

By Captain N. E. HARDING.
Royal Army Medical Corps.

It will, I think, be generally conceded that the results of the ordinary text-book treatment of tapeworm are very unsatisfactory, and that patients have an unpleasant habit of returning six weeks or two months after treatment, with the news that segments of the parasite are again appearing. Now, though the presence of a tapeworm doubtless does little or no actual harm, yet it has a most serious mental effect on some patients, causing in one case I have known a mild attack of melancholia. It is in consequence of this that I venture to bring forward a method of treatment which, though it has no claim to originality, being merely a very trifling modification of that used in the University Medical Clinic at Heidelberg, is so undoubtedly efficacious as to deserve to be better known than at present is the case in the United Kingdom. It is based on the fact that while the ordinary pharmacopœial dose of male fern is too small, and does not continue its action long enough to ensure the death of the parasite, a larger single dose may produce marked toxic symptoms. The drug is accordingly administered in the form of gelatine capsules, each containing about a gramme, at short intervals, and thereby avoiding the nausea which is generally so markedly produced. Two illustrative cases are the following:—

Private J. M. first noticed the worm at Potchefstroom in 1902. His medical history sheet shows an admission for it in May, 1903, and another in April, 1907. July 7th, 1907: Bowels freely opened with mist. alb. and no food given after noon, but some milk at 5 p.m. July 8th, 1907: Given ten capsules of male fern at intervals of six minutes between 8 and 9 a.m., followed by three ℥i. doses of a saturated solution of mag. sulph. at intervals of twenty minutes. Passed about 80 feet of worm, apparently belonging to two or more parasites, but no head could be found. He was kept on light diet till July 11th, and then treatment was repeated, the bowels having been opened with castor oil the previous evening. Had seven or eight stools, in which no trace of a worm could be found. November 17th, 1907: Has seen no trace of worm since July. Given a dose of castor oil, which failed to bring away any of the parasite.

Dr. W. E. B. first noticed worm in March, 1906, and was then treated with male fern. It soon recurred, and he was again treated in December. I first saw him in February, and treated him as above. Up to June no recurrence had taken place, so he was given a dose of castor oil, but

none came away. October 2nd, 1907: No trace of worm has been seen by him since last note.

It may be remarked that in neither of the above cases was any nausea or toxic symptom produced, and that the worm was *Tænia mediocanellata,* and not *T. solium,* as it is commonly but incorrectly returned.

MILITARY FAMILIES' HOSPITAL, PORTSMOUTH.—ECTOPIC GESTATION—ABDOMINAL SECTION—RECOVERY.

By Lieutenant-Colonel W. B. THOMSON.
Royal Army Medical Corps.

Case of Mrs. H., aged 35, wife of a master gunner, Royal Garrison Artillery.

Previous History.—The patient states that menstruation commenced when she was between 11 and 12 years of age, and continued regular at three weeks interval. Married when she was 21. First pregnancy six and a half years later; child born at full term. Four years after this had her second child, also at full term. About four and a half months after the birth of this child patient had a miscarriage. She was told at the time that she had had a "false conception." After this attack menstruation did not reappear, and four and a half months later she was delivered of a still-born male child. This occurred in November, 1903, since which date she has never felt well, suffering pain and discomfort in the right side of her abdomen, her menstrual periods being attended by considerable loss of blood.

Present Illness.—Admitted to hospital on May 13th, 1907. Some ten days prior to this she had been seized with flooding, attended with severe abdominal pain, and had passed a large pear-shaped clot. Menstruation had not occurred for some six or seven weeks. The medical officer in attendance was of opinion that she had miscarried. On admission into hospital she was anæmic, looked ill and appeared to be in great pain. Abdomen somewhat tympanitic, and more or less tender on pressure throughout, but particularly so in the right iliac region. The tongue was furred, pulse rapid, and temperature 100° F. Bowels regular. No pain or discomfort on defæcation. She complained of irritability of the bladder with difficulty in passing urine. The day after admission retention occurred, necessitating a catheter being passed. The urine was acid; albumin absent. She was losing a moderate amount of dark grumous discharge *per vaginam.*

On abdominal palpation a tumour was felt in the right iliac region, rising some four fingers' breadth above the pelvic brim. On vaginal examination a tense, hard mass was found occupying the right fornix and Douglas' pouch. Bimanually fluctuation was obtained. This enlargement was separated from the uterus, which was drawn up and displaced

forwards and to the left side. The cervix had practically disappeared and the os uteri had become a mere depression, high up and in close proximity to the pubes. Under rest and treatment with salines, iron, ergot, stupes to the abdomen and prolonged hot vaginal douches, all inflammatory symptoms subsided. The tumour, however, did not diminish in size. The uterine discharge, though less, continued, and the symptoms of pressure on the bladder were at times troublesome. These facts, together with the uncertainty as to the precise nature of the tumour, led me to decide on opening the abdomen in place of attempting any operation *per vaginam.*

Operation.—On June 28th the patient was placed under an anæsthetic (A.C.E.) by Lieutenant J. A. Bennett, R.A.M.C. An incision was made in the median line from about 1 inch below the umbilicus to 2½ inches above the pubes. On opening the peritoneum a rounded purplish mass, with large veins ramifying over its surface, presented itself in the wound. This was found to occupy and distend the right broad ligament. An ovariotomy trocar was inserted, and a quantity of dark blood of the consistency of treacle escaped. The opening was then enlarged, the walls of the sac seized with forceps, drawn up, and the contents, which consisted of firm blood clot, removed. A line of catgut sutures were then passed, joining the edges of the sac to the peritoneum and skin, the rest of the opening in the peritoneum being closed by means of interrupted sutures of catgut, and the skin with silkworm gut. The cavity was a large one, extending down into the pelvis. This was irrigated out with sterilised water and packed with gauze.

Only a moderate amount of collapse followed the operation. Vomiting and retching passed off within twelve hours. Tympanites was at first a little troublesome. This was relieved on the bowels being moved with the aid of small repeated doses of calomel, on the third morning after the operation. The dressings were then removed. The after progress of the case was necessarily slow, but gave rise to no anxiety. The cavity, being a large one, took some time to contract and fill up from the bottom. It was irrigated out, at first twice a day, with a solution of peroxide of hydrogen, by means of a glass tube passed to the bottom. It gradually became a mere sinus and eventually closed. There was a good firm cicatrix at the site of the incision. The patient was discharged from hospital on September 6th, much improved in general health and free from all discomfort. Menstruation occurred once before leaving, lasted four days, and was normal in amount. On vaginal examination the uterus was found to be in its proper position. A portion of the contents of the tumour was forwarded to the Royal Army Medical College for examination. It was reported to consist entirely of blood-clot, no trace of fœtal tissue or membranes being found.

I am much indebted to Major E. W. Bliss, R.A.M.C., surgical specialist, for his assistance at the operation.

THE ENTOMOLOGICAL COLLECTION AT THE ROYAL ARMY MEDICAL COLLEGE.

By Lieutenant-Colonel N. MANDERS.
Royal Army Medical Corps.

A good beginning has been made in forming a representative collection of phlebotomic diptera, as is shown by the subjoined list. This is largely the outcome of Lieutenant-Colonel W. B. Leishman's appeal in the Journal some few months ago. It is to be hoped that more material will arrive from time to time, and such will be duly acknowledged in the Journal. It will be noticed that many of the commonest species are still required, and correspondents need not fear sending too many specimens of even the most abundant blood-sucker. They should bear in mind that insects without a label giving place and date of capture, are practically valueless for scientific purposes. The temporary labels are subsequently printed off and attached, with the donor's name, to the specimen.

Name of insect	Donor's name	Total	Locality
Glossina palpalis ..	Capt. Best .. .. (6) Dr. Densham .. .. (11)	17	West Africa. Uganda.
,, *morsitans*	,, ,, ...	15	,,
,, *pallidipes* ..	Bt.-Lt.-Col. Leishman (4) Dr. Densham .. .. (3)	7	,, ,,
,, *fusca*	Capt. Best	6	West Africa.
,, *longipennis*	,, ,, ...	6	,,
Tabanus pluto	Per Lieut.-Col. Leishman ..	1	?
,, *fasciatus*	Capt. Harvey	5	West Africa.
,, (sub. sp.) *niloticus* ..	,, ,, ...	1	?
,, *Kingsleyi*	Capt. Best	6	West Africa.
,, *biguttatus*	,, ,, ...	1	,,
,, *disjunctus*	,, ,, ...	3	,,
,, *variatus*	Capt. Harvey	2	,,
,, *quadrisignatus* ..	Dr. Densham..	1	Uganda.
,, *gratus*	,, ,, ...	2	,,
,, *thoracinus*	,, ,, ...	4	,,
,, *Denshami*	,, ,, ...	2	,,
Hippocentrum versicolor ..	Capt. Best	4	West Africa.
,, *trimaculata*	,, ,, ... (1) Dr. Densham .. .. (1)	2	,, Uganda.
Chrysops silacea	Capt. Best	4	West Africa.
Hæmatopota pulchrithorax ..	Dr. Densham	3	Uganda.
,, *brunnescens* ..	,, ,, ...	1	,,
,, n.d.	,, ,, ...	2	,,
Hippobosca maculata	Capt. Best	4	West Africa.
,, *francilloni*	,, ,, ...	2	,,
Malophagus ovinus	Lt.-Col. Leishman	5	England.
Auchmeromyia luteola	Dr. Densham	2	Uganda.
Stomoxys calcitrans	Lt.-Col. Leishman	6	England.
,, ,, (African race)	Dr. Densham	1	Uganda.
,, n.d.	,, ,, ...	1	,,
,, *nigra*	,, ,, ...	6	,,

As nothing is more common, and at the same time more discouraging, than to find one's collection ruined by mould, I give the following prescription for its prevention. I received it through the kindness of Mr. E. E. Austen, F.Z.S., who tells me that it has proved efficacious on the Gold Coast and elsewhere. It can, therefore, be confidently recommended. Make a saturated solution of naphthalin in chloroform; mix this with an equal quantity of ordinary (beech-wood) creosote, and rub the inside of the box thoroughly with a sponge or piece of cotton-wool soaked in the mixture, until the cork lining shows through (the paper). The fluid must not be allowed to touch the specimens or they will be injured.

The above genera are not in their correct sequence. I hope to give an account of the *Culicidæ* very shortly; their numbers are considerable, but the condition of most makes determination hazardous. I wish to say that, though Mr. E. E. Austen is ever ready to help me in a difficulty, I hold myself responsible for the correct naming of the above specimens.

Since writing the above I have received a collection from Captain F. G. FitzGerald from the West Coast, and through Lieutenant-Colonel Leishman a very fine collection of *Culicidæ* and *Stomoxys* from Colonel A. Peterkin in Mauritius: these will be dealt with subsequently. They are in first-rate condition, and judging by the over-powering aroma from the boxes when opened, they were evidently treated by the above method, which has proved most efficacious.

NOTES ON CASES SHOWN AT THE WEEKLY CLINICAL MEETINGS HELD AT THE ROYAL HERBERT HOSPITAL, WOOLWICH.

By Lieutenant J. R. FOSTER.
Royal Army Medical Corps.

Star-shaped Fracture of the Patella. Shown by Major Holt, D.S.O., R.A.M.C.—Gunner B., admitted with star-shaped fracture of the right patella, due to a kick from a horse. Skiagram showed fragments in good position. Limb was put on a back splint for four weeks, then in a poroplastic splint, and massaged every day.

Herpetic Rash; Syphilis. Shown by Major French, R.A.M.C.—Private A. contracted a primary sore in February, 1907. In August he was admitted to this hospital with "bullet glands" in the groin, and herpetic vesicles on his penis, and over his body. Major French pointed out that a syphilide may take a herpetic form.

Lupus Vulgaris in a Syphilitic Subject. Shown by Major French, R.A.M.C.—Private H., admitted with symmetrical ulceration of the alæ of of the nose and of the tip of the right ear, with loss of tissue of these parts, and superficial brown scarring on the side and the crown of the head. There

is a clear history of syphilis, the patient having been in hospital seven times suffering from the latter disease. The diagnosis of lupus was held also by Mr. Darcy Power, who visited the hospital. The history of syphilis had caused the disease to be wrongly diagnosed.

Fracture of Tibia. Shown by Major Holt, D.S.O., R.A.M.C., with skiagrams.—Private M., admitted with wedged-shaped fracture of the upper end of the left tibia, due to a kick from a horse. There was no displacement, and no crepitus could be felt. This case was shown as exhibiting the value of X-rays; without their aid it would have been impossible to make an early diagnosis of the condition.

Fracture of Head of Radius, line of Fracture Running Parallel to Long Axis of Bone. Shown by Major Holt, D.S.O., R.A.M.C., with skiagrams.—Trooper S. was admitted complaining of severe pain in the arm on movement. He had had a fall from his horse. There was no deformity, and no crepitus could be felt. The fracture could only be diagnosed by X-rays.

Fracture of Humerus with Dislocation of Shoulder Joint. Shown by Major Holt, D.S.O., R.A.M.C., with skiagrams.—Private McC., invalided home from India with old united fracture of the right humerus and old unreduced backward dislocation of the humerus due to a fall from a horse. The muscles round the shoulder-joint, including the trapezius, were wasted. He was unable to move his arm. Major Holt excised the head of the humerus. At present, the patient can move his arm as high as the shoulder, and is improving with massage, though his muscles are still very wasted.

Fracture of Base of Skull. Shown by Major Holt, D.S.O., R.A.M.C.—Private R. fell from a waggon and was brought to hospital. There was no loss of consciousness, the only symptom present being slight bleeding from the left ear. Five days after the accident there was some discharge of cerebro-spinal fluid. This patient made a complete recovery.

Degeneration of Cardiac Tissue. Shown by Major Ritchie, R.A.M.C.—Bandsman A., a cornet player, complained of pains over the heart, swelling of the legs, and inability to blow the cornet, owing to shortness of breath. On examination, his apex beat was found to be displaced and diffuse, his pulse feeble, and his liver enlarged. No murmurs could be heard.

Perforation of Nasal Septum. Shown by Major Moore, R.A.M.C.—Private L. came to hospital with a history of having fallen off his horse four months before, after which he was noticed to snore, and was treated for nasal obstruction. When seen by Major Moore there was thickening of the fauces and uvula, ulceration of the back of the throat, and a perforation was found in the nasal septum. There was no history of syphilis, but a suspicious scar was found on the glans penis.

Meningitis. Shown by Major Rivers, R.A.M.C.—Private B., admitted complaining of headache and malaise. He had a slight rise of temperature

on admission. Urine sp. gr. 1002, contained albumin and sugar, no oxybutyric acid and no acetone. The temperature rose steadily after admission to between 101° and 102° F., and he became drowsy. He was diagnosed as a case of diabetes. He became steadily worse, and on the eighth day after admission his temperature suddenly rose to 107·8° F. and he died two hours afterwards. *Post-mortem* examination.—Brain—pus on base. Ventricles filled with turbid fluid. No organisms in pus or fluid. Heart and kidneys normal. The lungs showed hypostatic congestion of the left base. Pancreas, large and firm.

Compound Dislocation of Elbow-joint. Shown by Captain Matthews, R.A.M.C.—Boy C., admitted with a compound dislocation of the left elbow due to a fall from a horizontal bar in the gymnasium. Both bones of forearm were protruding through skin behind, and both condyles of humerus were fractured. The dislocation was reduced under an anæsthetic, and the internal condyle was screwed into position. The external condyle was too splintered to do anything with. A gauze drain was put into the wound and left there for two days. The arm was put on an angular splint for fourteen days, when passive movements were begun. The wound healed without suppuration, and the patient has now practically perfect movement in the joint.

Heart Disease. Shown by Lieutenant-Colonel Sutton, D.S.O., R.A.M.C.—Serjeant M. came to the hospital for a bottle of medicine, as he was not feeling well. He was examined and found to have mitral and aortic regurgitation and a hæmic præsystolic murmur, which afterwards cleared up. This case was brought forward as pointing to the necessity of a careful examination in a man reporting sick.

True Rupia in Syphilis. Shown by Major French, R.A.M.C.—Gunner F., admitted with severe rupia. He contracted malignant syphilis in 1906, in England, and was treated in London by injection of insoluble grey oil, with no effect on the disease. Major French said that true rupia was extremely rare in syphilis contracted in England, but more frequent in the severe cases met with abroad. The man was treated with mercury inunctions and potassium iodide. The rash has practically cleared up. From some of the healed scars on the face a relapsing nodular syphilide later developed.

X-RAYS AS AN AID TO THE DIAGNOSIS AND LOCALISATION OF HEPATIC ABSCESS.

By Major C. B. LAWSON.
Royal Army Medical Corps.

During the year 1907 three cases of abscess of the liver were admitted to the Military Hospital, Valletta, Malta, and in each case the localisation of the collection of pus was greatly assisted by the use of X-rays, the abscess in every case being struck at the first puncture. The method

of X-ray examination employed was fluoroscopy with a medium tube (4 or 5 inch spark gap), 24 volts from accumulators, and a Mackenzie-Davidson mercury-break. The patient was placed either in the recumbent or sitting posture, and the area of hepatic dulness was screened both in the antero-posterior direction and obliquely. The cases were:—

(1) No. 7498, Private W. E. L., 2nd Royal West Kent Regiment, who was landed from H.M. Transport "Sicilia" on January 20th, 1907. The patient was being invalided from Pekin for debility. He gave a history of dysentery, pyrexia and sweating. His blood showed a leucocytosis of 20,000 per cmm., and his liver was greatly enlarged. Screening showed a shadow about the size of the fœtal-head in the centre of the region of the right lobe, the lower part of the shadow appearing on a level with the eighth rib in the mammary line. The patient had to be examined in the recumbent position as he was too ill to sit up. His diaphragm was motionless on the right side. An aspirator needle was inserted in the seventh space in the anterior axillary line, 2 inches of the seventh rib were resected, and 1½ pints of characteristic tropical liver abscess pus evacuated.

(2) No. 11,933 Sapper R. L., Royal Engineers, diagnosis hepatitis (?), abscess. Screening showed small shadow near the upper limit of hepatic dulness on the right side. The aspirator needle was inserted in the mid-axillary line in the ninth space, and directed towards the position of the shadow. Four ounces of reddish-brown pus were evacuated.

(3) No. 729 Staff-Serjeant E. J. B., Army Pay Corps, admitted with hepatitis (?), right sided pleurisy (?), liver abscess. The first screening showed fluid in the pleural sac. This became absorbed, and on screening again a dome-shaped shadow encroaching on the right chest was visible. The diaphragm on this side had an excursion of about ½ inch. This dome-shaped swelling could not be made out by the ordinary methods of clinical examination. The patient had a tender spot 1½ inches below and external to the right nipple. The aspirator needle was inserted here and directed towards the dome-shaped shadow, pus being struck at a depth of 3 inches. A portion of the eighth rib between the nipple and the anterior axillary lines was removed and a large drainage tube inserted. Five ounces of thick curdy pus were drawn off.

The seeing of a single shadow gave at the outset a hopeful prognosis, which, I am happy to state, has been quite realised, as all the cases have recovered.

Echoes from the Past.

A FORGOTTEN ANTHROPOLOGIST— SURGEON-MAJOR GEORGE WILLIAMSON, Army Medical Service.

By ARTHUR THOMSON, M.A., M.B., F.R.C.S.
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Of Surgeon-Major George Williamson, M.D., the man and the officer, I know but little. A native of Peeblesshire, he was born on March, 6th, 1819. He appears to have taken the Diploma of the Royal College of Surgeons of Edinburgh in 1838, and was granted the M.D. of the University of Edinburgh in the year 1840 for a thesis on lithotomy. He entered the Army Medical Service as an Assistant-Surgeon on March 26th, 1841, and was promoted successively, Surgeon in 1849, and Surgeon-Major in 1851. He served in India from 1849 to 1855, was in Turkey and the Crimea from January to July, 1856, and spent from April, 1860, to October, 1861, at the Cape of Good Hope. He died on October 31st, 1865.[1] Unfortunately, I have been unable to find any obituary notice of him in the *Lancet* of that year. The above meagre details are all that seem available with regard to Surgeon-Major Williamson's military career.

Having recently had an opportunity of inspecting the collection of human skulls now deposited in the Museum of the Royal Army Medical College, at Millbank, London, I have been greatly impressed by the manuscript catologue prepared by this enlightened officer. At the time when this collection was first formed, physical anthropology was still in its infancy. To Blumenbach is due the credit of having first aroused an interest in this subject, an interest which was steadily maintained by the work of his numerous disciples on the Continent, and which spread alike to America, where, in 1839, that philosophical anatomist, Morton, published his classic treatise on the "Crania Americana." As yet little had been done in a systematic manner in this country. In a general way, the subject had been treated by Lawrence, Prichard, Latham and Knox; but if we except the anatomical description of the human crania and skeletons published by Owen in the catalogue of the

[1] For these details I am indebted to Lieutenant A. Irvine Fortescue, R.A.M.C.

Osteological Series of the Museum of the Royal College of Surgeons of England (1853), there was no work strictly confined to the ethnological bearings of craniometry prior to the appearance of Surgeon-Major Williamson's catalogue in the year 1857. At that time, the collection of which he was in charge was housed in the cellars of Fort Pitt, Chatham, then the headquarters of the Army Medical Department. Subsequently, however, the skulls were transferred to the Museum at Netley Hospital, and have recently been brought to the Royal Army Medical College, Millbank, London, where they are now lodged, and where they will, I trust, be open to the inspection of all interested.

Williamson's catalogue first appeared in print in the pages of the *Dublin Quarterly Journal of Medical Science* in the year 1857. It was subsequently reprinted in pamphlet form by MacGlashan & Gill, of Dublin, but unfortunately in neither instance, owing no doubt to the question of expense, were the elaborate tables of measurement included, a few only, in which some of the results were summarised, being published.

The appearance of this catalogue, now all but forgotten, was undoubtedly the pioneer work of its kind in this country, for be it remembered that the "Crania Brittanica" of Thurnam and Davis was not published till 1865, and Barnard Davis' "Thesaurus Craniorum" did not see the light till 1867. It is pleasant to know, however, that Williamson's work did not altogether escape recognition, for I find on consulting the historical account of the subject furnished by Topinard in his "Elements of General Anthropology,"[1] that that author speaks of the catalogue as a very remarkable production, and lays particular stress on some of Williamson's observations. Busk, too, whose name is familiar to all English anthropologists, in a review which was published in the *Natural History Review* (October, 1862, p. 359), pays a high tribute to Williamson's "very valuable and interesting account of the collection of crania at Fort Pitt." Davis also, in the preface to his "Thesaurus Craniorum," duly recognised his work.

Unfortunately, owing to the ephermal and incomplete form in which the catalogue was published, Williamson's work has not received, in these later days, that attention and recognition which it deserves. I have endeavoured to obtain a copy of the pamphlet, but hitherto without success. The only copies I have as yet had an opportunity of examining are, one in the Bodleian Library,

[1] "Eléments d'Anthropologie Genérale," 1885.

where I found it in strange company, bound up with, amongst others, a tract by Spurgeon on "How I became a Baptist," and a sermon by an eminent Divine on "Growth in Grace and Knowledge"; and another, an interleaved copy which Williamson presented to the Library of the Royal College of Surgeons of England. This specimen is one of great value, because it is illustrated by forty-four photographs of skulls in the collection. These photographs, the size of which is 5 in. by 4 in., are silver prints, and, notwithstanding the fact that they are now 50 years old, are still, despite a tendency to yellowishness, in a good state of preservation.

Undoubtedly Williamson owed his inspiration to Morton; for we find in a comparison of his catalogue with the "Crania Americana," that he adopted the same measurements and tabulated many of his results in identical form. To Professor Owen, too, the Curator of the College of Surgeons' Museum, he no doubt was indebted for the interest he took in wormian bones and the arrangement of the sutures in the region of the pterion. But he was far from being a slavish follower of either of his masters' methods; for in the accounts he gives of his mode of making the measurements he says: "The facial angle of Professor Camper was at first taken by an instrument recommended by Mr. Morton, but this plan was found to be very tedious and required considerable time. . . . A very simple method was devised by which from thirty to forty angles could be taken in an hour. It would be impossible to make a description of it intelligible without the aid of a drawing. The accuracy of this instrument was tested in various ways and found to be correct." Possibly this instrument still survives amidst the lumber which accumulates in a museum; if so, it would be well worth preserving.

Unfortunately, unlike Morton, who by the generosity of friends was enabled to publish the results of his labours on the aboriginal American crania in a sumptuous volume, Williamson failed altogether to get adequate means to make known the results of his arduous researches. Reading between the lines, it can hardly be doubted that he applied for Government aid, for we find that under his editorship a catalogue of the pathological preparations in the museum was published by the Government, and distributed to every medical officer in the Service. Then, as now, the State seems to have failed in its duty to further scientific research.

Of the catalogue itself, with which I am only familiar in manuscript form, I cannot speak too highly. It embraces a description of over 450 skulls, together with detailed measurements of the

same, amounting in all to over 8,000 observations; added to this there are generalisations of much value and numerous analytical tables. The author must have been a man of keen observation, for he was amongst the first to lay stress upon the value of the nasal aperture as an ethnic character. His researches, too, on the varying arrangement of the sutures in the region of the temporal fossa were remarkable, and foreshadowed, if they did not entirely anticipate, the results obtained by Anoutchine some twenty-five years later.

As an example of his pithy, descriptive style, and his powers of analysis, I may be permitted to quote his summary relating to the Hottentot and Bushman crania: "From the foregoing description of the Hottentot and Bushman skulls, it will be observed that there is a great resemblance, and that the Bushman presents the same characters in a more exaggerated form. They are both, however, entirely different from any other class of skull in the collection, looking at them collectively; although many of the characters when taken separately resemble the skulls of other races, such as the Ashanti, the Negro, and likewise the Malay. They do not in any particular resemble the Chinese. The similarity between the Hottentot and Bushman and the Ashanti skulls consists in both being of small size; the forehead smooth, high, well arched and nearly perpendicular with the bones of the face; the great breadth between the eyes; the nasal bones oblong and on the same plane; and the size and form of the nasal aperture. The alveolar processes are broad in front, but they project more in the Ashanti than in the Hottentot or Bushman, although in some of the Hottentots the alveolar processes project as much as in the generality of the Ashantis. In the Hottentot and Bushman the malar bones stand more prominently forwards and outwards, causing the face to have a broader and flatter appearance. The shape of the cavity is of an oval form in the Hottentot and Ashanti. The Bushman's skull is of a square form. The points of resemblance between the Hottentot and Bushman, and the Malay are the broad, flat face, the outward projection of the malar bones, the frontal, nasal and malar bones and alveolar processes being nearly all on the same plane. In the Bushman and Malay the skull is of a square or round form, and the transverse diameter of the base of the skull is great, compared with the antero-posterior. However, on comparison, the difference is very striking; the Malay skull is large and capacious, with the nasal bones always more or less arched, the breadth between the eyes is great in both, and the

anterior nasal aperture is larger and wider. The Hottentot and Bushman's skulls are the smallest in the collection, and the nasal bones are on the same plane and flatter, with greater breadth between the eyes, than in any other skull. The anterior nasal aperture also approaches nearer to the Negro form. Although it has been stated that there are many points of resemblance between the Hottentot, the Bushman and the Malay, yet, on comparing the three classes of skulls, the Hottentot and Bushman have the greatest resemblance to the Negro, especially to the Ashanti, the Hottentot approaching nearer to them than the Bushman."

My interest in Surgeon-Major Williamson's work having been thus aroused, I was naturally anxious to know whether he had displayed like ability and energy in other branches of his profession. On consulting the "Index Catalogue of the Library of the Surgeon-General's Office of the United States Army," I find under his name the subjoined works :—

"Catalogue of Preparations, &c., in Morbid Anatomy and Experimental Philosophy, contained in the Museum of the Army Medical Department, Fort Pitt, Chatham," xx., 450 pp. London: Smith Elder and Co., 1845.

"Observations on the Human Crania contained in the Museum of the Army Medical Department, Fort Pitt, Chatham," 87 pp. Dublin: MacGlashan and Gill, 1857.

"Notes on the Wounded from the Mutiny in India, with a Description of the Gunshot Injuries contained in the Museum, Fort Pitt, Chatham," iv., 124 pp., 11 pl. London: J. Churchill, 1859.

"Military Surgery," 225 pp., 11 pl. London: J. Churchill and Sons, 1863.

"Chirurgia Militare." Trad. dall' Inglese.

"Connote dell', Edoardo Boccomini," 393 pp., 160, Milano, 1864.

I am not competent to express an opinion on the merits of these surgical treatises, but from motives of curiosity I read the preface and introduction to his "Military Surgery." Therein I found much which seems to me characteristic of the man. Thus, in comparing the results obtained in cases of compound fractures due to gunshot wounds in the Mutiny with those in the Crimea, he writes, "Medical officers who have served in India are, I believe, unanimous in opinion that there is no means of transit for sick and wounded equal to the dooley; and should this be admitted by the public and Government, there seems no reason why our Indian subjects should not furnish us with a supply of dooleys and bearers in all our wars out in India." These words seem almost prophetic in view of our recent experience in South Africa.

Again, at the present time, when the Medical Service of the Army is being reorganised, it is interesting to note that Williamson, in the introduction to his "Military Surgery," lays stress upon the application of hygiene to the Army as a subject of the greatest importance; and further emphasises this point by quoting from a speech by Lord Herbert, the then Secretary of State for War, on the occasion of the opening of the Medical School at Fort Pitt in 1860, to the effect that the "objects contemplated by the Government in establishing this School were not only to give an acquaintance with the specialities of military medical life, but especially to teach the most approved methods of preventing disease." Another excerpt from the same address is not without interest at the present time. Lord Herbert went on to say that "He had just been reading a letter from the Adjutant-General with the Army in China. He conveyed the most gratifying accounts of the present excellent condition, as to health, of the China force; and it showed how much benefit had arisen from the appointment of a sanitary inspector. This was the first time such an appointment had been made. It was one of the new regulations, and was the result of the recommendation of the Royal Commission (1858)."

That Williamson was alive to the importance of tropical medicine is made clear by his remark to the effect "that the results of tropical diseases as revealed by *post-mortem* examinations can also be well studied at the General Hospital at Netley."

Enough has been said to prove that Williamson was a man of remarkable ability and foresight, one of whom the Service may be justly proud. Of his merits as a craniologist it is impossible to speak too highly. So far as I know, he was among the first, if not the first, to publish a systematic catalogue of any collection of human crania in this country. But apart from the mere labour of such an undertaking, he drew inferences and deduced conclusions which will stand good to the present day. Had his researches obtained a wider publicity, and enjoyed the advantages of publication in more permanent form, they would now have been the classic work on the subject in this country, just as Morton's account of the native aboriginal skulls holds the premier position in America.

Is it too late to suggest that some means should yet be taken to perpetuate Surgeon-Major Williamson's memory? Might this not be done by associating his name with the craniological collection of the Royal Army Medical College? The catalogue so far as it goes is almost complete. The records of the measurements could readily be translated into the metric system, and other obser-

vations which recent advances have proved of most value could easily be added, so that the College could yet be the first in this country to publish a complete and carefully revised account, descriptive and statistical, of the skulls in its possession. It would be a fitting tribute to the memory of the man who bestowed such loving care on this collection in days gone by.

Travel.

A TRIP THROUGH PORTUGAL IN 1905.

By Lieutenant-Colonel J. E. NICHOLSON.
Royal Army Medical Corps (R.P.).

THE following holiday trip may be undertaken at almost any time of the year, but as in Portugal the weather from December to March is apt to be wet and changeable, I would advise any of my friends who wish to see the country at its best—unless they propose to winter at Lisbon or Mont' Estoril—to postpone their sight-seeing until the advent of spring, when they can take their choice of any of the next eight consecutive months.

The best way to start visiting Portugal is to commence at either Lisbon or Oporto, preferably the latter. Both these cities can be reached by rail or steamer. I myself travelled by sea, and about six hours after leaving the Bay of Biscay the steamer anchored at sundown in the harbour of a place of which the name is written *Leixões* and pronounced "*Leshoens*."

About 9 a.m. the following morning those of the passengers who proposed staying in Portugal landed at Leixões, and, after due inspection of their passports and luggage at the Custom House, took the *electric* car to Oporto. Although this is perhaps a slightly longer journey than that taken by the *steam* trams (which take the inland route), it offers the more picturesque views, as it first follows the coast-line to Foz, at the mouth of the Douro, and then runs along the right bank of this beautiful river into the heart of Oporto. Like most of the English visitors to this town, I stayed at the Grand Hotel.

Oporto (in Portuguese, Porto) is the second largest city in Portugal, with a population of about 170,000, and its chief exports are wine and fruit. The first feature to attract one's attention is

the wonderful iron bridge of Dom Luiz, which here spans the river Douro by a single arch, the distance between the piers being close on 200 yards, the steep banks being connected by a high-level and a low-level carriage way, forming respectively the tangent and the chord of the arch. The chief sights of the town are the *Bolsa* (Exchange), which is a magnificent building and contains a handsome ballroom, elaborately decorated after the style of the Alhambra; the *Sé* (Cathedral), dating from the fourteenth century; the *Santa Casa*, with the notable picture of the Crucifixion, "Fons Vitæ," of which the authorship is still a mystery; the *Torre dos Clerigos*, from the summit of which a grand view over Oporto is obtained; the *Crystal Palace*, with its beautifully laid-out grounds and lovely situation; the *Campo dos Martyres*, in which tropical trees and plants grow in the open air; the *Praça de Dom Pedro*, the fine square in the centre of the city; and the famous *Wine Lodges* at *Villa Nova de Gaya*, on the southern bank of the river. All these sights, and several others, can easily be seen in two days, or even in one whole day if one is pressed for time.

If time is no object, an excursion to *Braga* should be made, and this—with a little early rising—can be done in one day. Leaving Oporto by the 7.10 a.m. train, Braga, the "Mecca of Portugal," is reached about 9 a.m. After breakfast at the Grand Hotel, a visit is made to the Cathedral, which is a combination of Gothic and Renaissance architecture; the Archbishop of Braga, in opposition to the Archbishop of Toledo, claims the supremacy of "Archbishop Primate of all the Spains."

A tram ride of about three miles now takes one to the foot of a wooded hill called Mont' Espinho, on the crest of which is the Church of Bom Jesus do Monte, to which all good Portuguese Catholics are expected to make a pilgrimage at least once in their lifetime, Whitsuntide being the favourite time for the devotees to visit the sanctuary. The view from here is one of the finest in Portugal, and several days could well be spent in this lovely neighbourhood. The hotel (Grand Hotel) being under the same management as that at Braga, satisfactory arrangements for lunch or dinner at either place can be made to suit one's convenience. A return to Braga in time to catch the 4.40 p.m. train enables one to arrive in Oporto in time for dinner, but later trains, if preferred, can be selected up to 9.20 p.m.

Leaving Oporto at 4.20 p.m., by the afternoon express, Pampilhosa Junction was reached at 6.18, and dinner was awaiting us on our arrival. An hour later we entrained again for the next

station, Luso, which we reached in about twenty-five minutes. Here we took a coach which occupied considerably over an hour in a steep uphill climb of 5 miles in the dark to the top of "grim Bussaco's iron ridge." It was about a quarter past nine when the moon, just past the full, rose; we soon emerged from the dark forest, and I shall never forget my glorious first view of the magnificent Hotel de Bussaco, which was bathed in moonlight, and I could hardly realise that this fairy-like white palace was to be my home for the next few days. The sight recalled pleasant recollections of the Alhambra and of the Taj Mahal, which I had also been fortunate enough to see under similar conditions. An enticing supper was soon ready for us, after which my fellow-travellers dispersed for a good night's rest, but I was loath to retire until I had wandered round the hotel and viewed the lavishly ornate white building from all sides, and even after I had gone up to my room I remained for a long time at the open window, enjoying the beauty of the superb scenery by moonlight, the air being as clear as crystal. The good old Carmelite monks, who first selected this spot for their monastery, were no mean judges of natural beauty, and must have been Shintoists at heart.

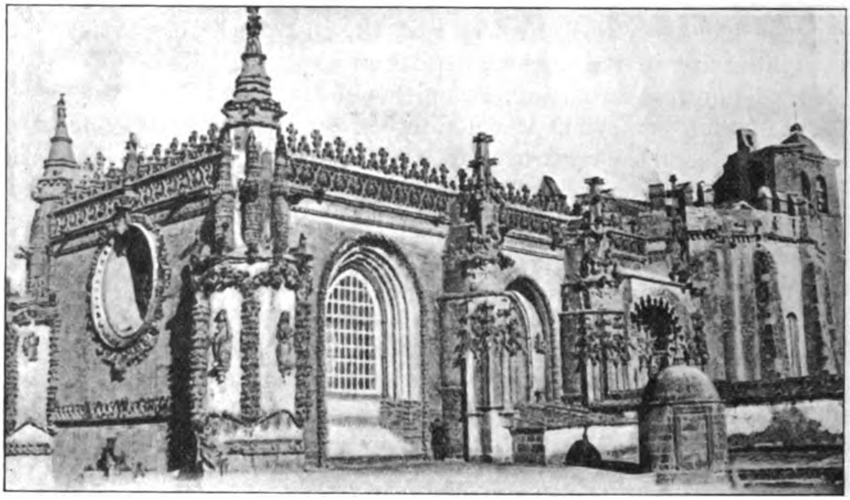
The next day, I discovered that the hotel was originally truly intended for a Royal Palace, and that the grounds (which once belonged to the old convent of Bussaco adjoining the hotel) extend 6 miles in circumference and are full of shrines and hermitages. Wandering down a fine avenue of cedars, I came to the "Coimbra Gates," outside the entrance to which are two Latin inscriptions, which a closer inspection showed to be copies of two Papal bulls; one, that of Urban VIII., excommunicating anyone injuring the trees in the sacred forest, and the other, a bull of Gregory XV., forbidding women to enter the convent grounds. Retracing my steps, I soon found a handsome stone staircase, in terraces, divided lengthwise by a merrily trickling stream with ponds at intervals; these steps led me down the hill to the monks' fish-ponds and medicinal gardens. I was also forcibly impressed by the great variety of trees composing the forest, oaks, palms, cedars, tree-ferns, beeches, fig-trees, eucalyptus, chestnuts and wild vines —in a word, a wealth of vegation unsurpassed in luxuriance and variety, to which the various climatic zones appeared to vie with each other in contributing offerings of their best. The monument to the memory of the Anglo-Portuguese Alliance on the historic battlefield is not the least of the attractions of the neighbourhood to any British officer, and the subject is still more forced on his

attention by the fact that the walls of the entrance hall of the hotel are inlaid with white and blue tiles depicting scenes in the battle of Bussaco.

After a few happy idle days in this "Cintra of the North," I had reluctantly to go further afield; and to avoid a very early start and monotonous train journey to *Coimbra* (locally pronounced "Queenborough"), I suggested to several acquaintances, who were also bound for that town, that we should *drive* there. The host was then called and the matter settled in a trice. So the following morning, instead of rising at 5 a.m. and starting hungry (for we could not get breakfast until we reached Pampilhosa Junction about 7.15), we rose as usual, and after an excellent breakfast started at our leisure for Coimbra, which we duly reached in about three hours' time. After lunching at the Hotel Avenida, to which our luggage had been forwarded by rail, the rest of the day was spent in sight-seeing in the ancient capital of Portugal. The University claimed our first attention, and although some of the ladies of the party found a somewhat warm climb in the sun up to its commanding position on the crest of a steep hill, rather tiring, we all enjoyed being shown over it, and in any case the fine view over the surrounding country from its Observatory was well worth the ascent. The Cathedral was somewhat disappointing, to my mind, although it dated back to the twelfth century; but I saw the finest collection of sacred relics in Portugal. The descent of the hill offered a pleasant contrast to its ascent, and we now crossed the far-famed river Mondego (whose beauties are the theme of many poems), to see over the *Quinta das Lagrimas*, the former residence of the beautiful but unlucky Portuguese Princess, Inez de Castro, whose romantic story and tragic fate are so thrillingly described in Camoens' "Lusiads," and to whom I shall again have occasion to refer when describing my visit to Alcobaça. I was shown the "exact spot" where the murder was committed by order of her royal father-in-law; and also the *Fonte dos Amores*, or exit of the underground stream which—apparently in defiance of the laws of gravitation—carried the secret letters of Dom Pedro to his betrothed Inez, when she was imprisoned in the convent of Santa Clara on the adjoining hills. But why be too critical? I was then on a holiday tour, and only asked to be entertained, and even if my feelings were somewhat harrowed by the telling of the sad tragedy, I liked the story none the less for a few trifling romantic inaccuracies.

The next morning we left Coimbra, travelling by rail as far as

as Chão de Maçãs station (pronounced "Shong de Massangs"), whence we drove for five miles to *Thomar*. Some of my fellow-travellers inside the vehicle complained of the heat and stuffiness, but as I had the box seat, with the nicest lady of the party by my side, I had no possible cause of complaint; however, lunch at the Hotel União soon made everybody happy once more, and then we all proceeded to walk through the little town of Thomar up a little hill to the former stronghold of the Knights Templars. This building is a mixture of Gothic, Moorish and Portuguese architecture, supplemented and modified by the Knights of the Order of Christ, who built the adjoining *Convento de Christo*, which is still in an excellent state of preservation.

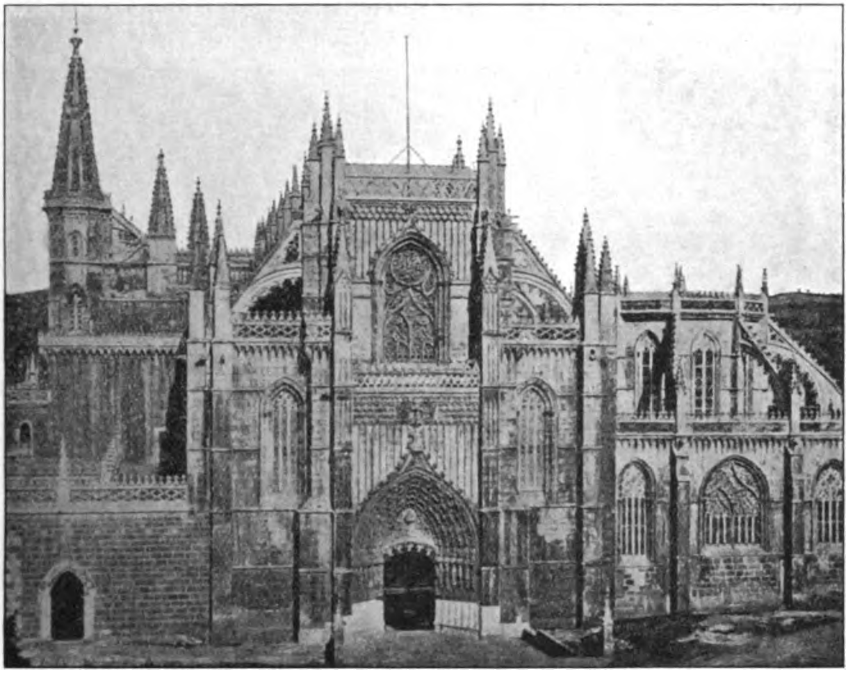


Convento de Christo.

The following day was passed in a long drive, through pretty country and in glorious weather, to *Leiria*, where we stayed the night at the Hotel Liz; we started again the next morning for another drive, this time to *Batalha*, about eight or ten miles further on, arriving there about 11 a.m. This beautiful monastery, which is built of marble-like limestone, most elaborately carved, was founded in 1388 by John I. and his English wife, Philippa, a daughter of John of Gaunt; the name "Batalha" is said to have been suggested to this Queen by our own "Battle Abbey," and is now a national monument of the victory which secured the

independence of Portugal. Nearly every monarch has added to its beauties until it is now considered to be one of the grandest monuments of Christendom. In the *Founders' Chapel* is the double tomb of John I. and Philippa of Lancaster, under a canopy, bearing the arms of Portugal and of England.

In the afternoon we continued our drive to *Alcobaça*, which we reached in time to see over the huge Cistercian Abbey by daylight. This Abbey is said to be the largest monastic building



ENTRANCE TO THE MONASTERY OF BATALHA.

in the world. It was founded by Affonso Henriques after the capture of Santarem, and in it Mass was said without interruption night or day for centuries by 999 monks; many of their dormitories are now used as barrack rooms. Several of the Portuguese Sovereigns are buried here, amongst others, Pedro I. and Inez de Castro, who lie feet to feet, in order that these faithful but unfortunate lovers may be the first to meet each other's eyes at the Resurrection. [I regret that I cannot now remember whether the ghastly coronation of Queen Inez, *seven years after her death*, on

the accession of Dom Pedro to the throne, took place here or at Batalha ; in any case she was murdered near Coimbra and buried at Alcobaça.] The *Sala dos Reis* contains the statues of the Portuguese Kings. The chapel of the many sacred relics, the *Claustro de Dom Denis*, and the large kitchen (through which a rivulet flows), are also well worth seeing.

After dining at the hotel, we drove to the station of Vallado to catch the train to *Caldas da Rainha* (Queen's thermal baths), where we stayed for the night at the Hotel Lisbonense. The next morning I roamed through this Portuguese Harrogate, visited the

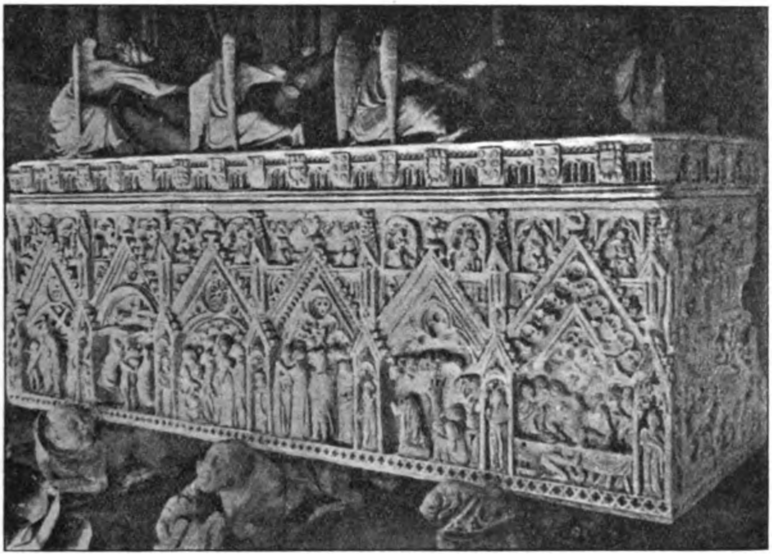
CISTERCIAN MONASTERY AND ABBEY AT ALCOBAÇA.

Hydropathic Establishment (hot sulphur springs), also the famed majolica factory, which I was kindly permitted to inspect, and where I was able to see all the details of the making of the celebrated glazed pottery, from the fresh raw clay to the finished article.

In the afternoon I took train for Cintra, and after passing close by the famous rampart lines of defence built by Wellington at Torres Vedras, arrived at Cacem Junction, where I changed for Cintra, but darkness had set in before I arrived. Here I found my luggage, which I had sent on in advance from Coimbra, for I had to travel in light marching order for the lengthy drives of the last

few days, and a small Gladstone bag for each individual was all that could be taken in the carriages owing to the steepness of many of the hills.

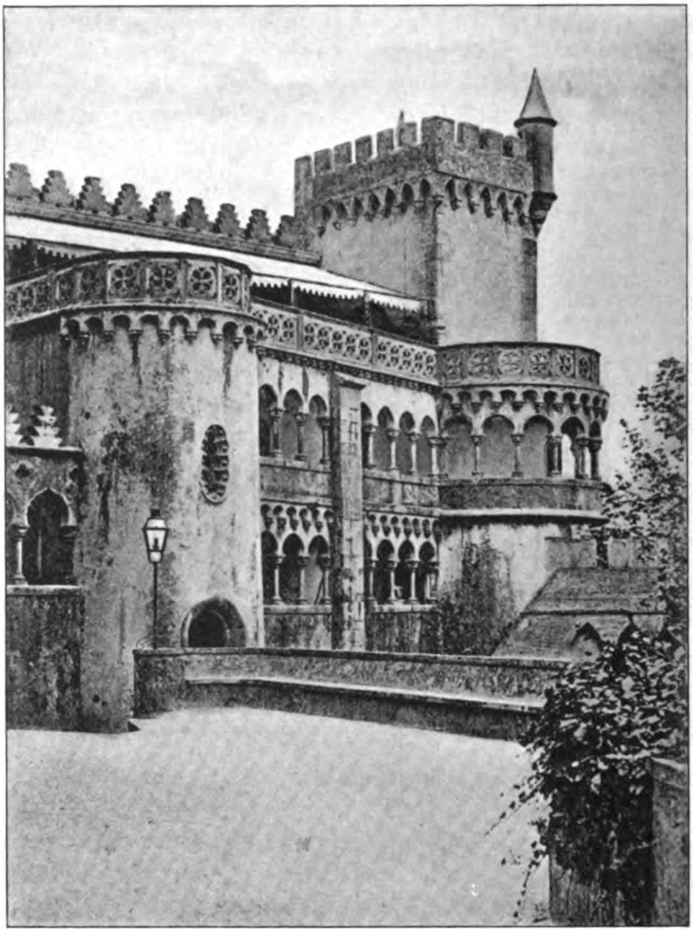
Cintra, which is gloriously situated among the mountains to the north of the mouth of the Tagus, is historically famous for the "Convention of Cintra" (which was really drawn up at Torres Vedras and signed at Lisbon, so, probably as a compromise, a spot midway from each was selected to give the treaty an impartial name), by which the French were actually allowed to evacuate Portugal with all their arms, stores, and booty, which foolish



Tomb of Queen Inez in Alcobaça Abbey.

lenience caused the recall and censure of Sir Hew Dalrymple, who had been "selected" to take over the chief command of the British Forces in the Peninsula, and thus supersede in the field Sir Arthur Wellesley, who had already won many laurels. *Mais revenons à nos moutons.* Cintra has long been the favourite summer residence of Portuguese royalty and aristocracy, and is full of interesting sights. In the little town is the *lower Royal Palace*, once the Alhambra of Moorish monarchs. A "pass" is said to be absolutely essential for seeing over this building; I had not got one, but I was fortunately in possession of the "golden countersign" for that day, and so managed to see all over the Palace, which is well worth a visit.

My first ascent to the *Moorish Castle* and to the *Palacio da Pena,* on the summit of the granite mountain, was not attended with success as regards the view, as the hills were thickly enveloped in damp mist, but I was able to see over the Upper Palace. I next



PALACIO DA PENA, CINTRA.

drove to the lovely *tropical glen* at Monserrate, but although I was not able to see over the mansion itself, as the family were residing there at the time, I was permitted to wander about the grounds at my leisure, in return for a small donation to the poor-box. From

here I proceeded on to the *Cork Convent*, and by the time I returned to the hotel it was getting very dark. The following morning, as the weather was glorious for distant views, I repeated my climb to the Moorish Castle, and this time I was rewarded with a sight of one of the loveliest panoramas in the world, and I can speak with experience after much travel and sight-seeing in four continents. Whilst at Cintra, I also made excursions to *Praia de Maçãs* and to the vineyards of *Collares*, &c., where the local wines were duly sampled, and more or less heartily approved of.

I was loath to leave Cintra, where I would gladly have remained for a few more weeks, but I had not yet finished my proposed tour (for I was in search of a spot where I could make my home), so I took train one afternoon for Lisbon, and was very lucky to get a bedroom at the Grand Hotel Central, overlooking the Tagus, for almost every available room in the capital had been booked in advance, in expectation of the visit of the French President.

"*Lisboa*," like Rome, is built on seven hills, on the northern side of the estuary of the Tagus, and for beauty of situation is unsurpassed—in my opinion—by any other capital of Europe, with the possible exception of Constantinople. From here the "Invincible Armada" sailed, when finally ready for the anticipated invasion of England. The city has a bright appearance, and is easily visited, owing to the excellent service of electric trams which traverse it in all directions. The *Praça do Commercio*[1] (or Black Horse Square, so called from its huge central ornament) is one of the very finest squares—as the Avenida is one of the finest avenues—to be found in Europe. The *Rocio*, the chief centre of traffic, has been nicknamed "Rolling Motion Square," from the optical illusion caused by the undulating pattern of its mosaic pavement. This square has witnessed many acts of torture in past times, as the victims of the Inquisition were burnt alive here; the "Court of the Inquisition" has been destroyed, and is now replaced by the Opera House. The *Sé Patriarchal* (Cathedral) is very disappointing and is easily surpassed by many of the churches, its chief sights being the Shrine of St. Vincent, and the "Sacred Ravens." The legend runs that the bones of the martyred Saint were found by King Affonso near Cape St. Vincent, the spot being guarded by ravens. When the relics were being conveyed by ship to Lisbon, the ravens accompanied them all the way to the capital.

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[1] [The scene of the recent barbarous assassination of His Majesty the late King of Portugal and of His Royal Highness the late Crown Prince.—Ed.]

St. Vincent thus became the Patron Saint of Lisbon, of which the arms are a ship and two ravens, and to this day live ravens are kept in the cloisters, as a living proof of the veracity of the legend. The beautiful ruins of the *Church of the Carmo* (now the headquarters of the Archæological Society), the *Bull Ring*, the *Palace* of the Ajuda, the *Aqueduct* over the Valley of the Alcantara, the *Markets*, and many of the *Churches*, should all be visited, but unfortunately want of space prevents a description of them here. On no account should the sights of the suburb of Belem (locally pronounced "Bleng," *not* "Balaam") be omitted, however short one's stay in Lisbon, and should include at least the *Church*, the *Convent*, and the *Tower*. The Tower was once an island, but the accumulation of sand and mud on the north side has enabled this channel to be

THE PRAÇA DO COMMERCIO, BLACK HORSE SQUARE, LISBON.

reclaimed, so that the Tower is now only a peninsula. It is still a picturesque landmark for ships, and good views both up and down the river Tagus were obtained from its battlements.

A day was spent at *Mont' Estoril* and *Cascaes*, which together form the Riviera of Portugal. This delightfully situated spot, just outside the mouth of the Tagus, is only about half an hour by rail from Lisbon, and whilst forming a popular *summer* resort for the Portuguese, is now also fast becoming a favourite *winter* resort for the English. Situated about 300 miles further south than the French and Italian Rivieras, well sheltered from northerly winds, with a southern aspect, excellent sea-bathing which can be enjoyed on most days throughout the year, good hotels, a Casino, beautiful

walks and drives, it has a splendid future before it, and that at no distant date.

On my way back to Lisbon I was fortunate enough to see the whole of the royal procession (with all the gala, state coaches, &c.), which was escorting the French President from Belem to Lisbon. In the evening, I spent nearly four hours in seeing the grand public illuminations, which were on a lavish scale, and by far the prettiest and most elaborate of any that I have ever seen—and I have been in many capitals and large towns on special gala days.

When at last I had to bid good-bye to Portugal, I did so with decided regret, for I had passed a very pleasant time there, and I can confidently recommend it to anyone wishing for *a delightful holiday in a country not yet overrun by tourists.* Travelling is not expensive, and English and French are spoken in all the more important hotels and shops. The currency may possibly be somewhat puzzling to strangers at first, but not more so than if they were travelling in North America. The *milreis* is practically the same as the American gold dollar (4s. 2d.), but contains 1,000 *reis* instead of 100 *cents*, therefore 10 reis are equal to 1 cent or half-penny; so that an article priced at 750 reis is worth 75 halfpence, or 37½ pence, or 3s. 1½d. For practical purposes, 5 milreis may be roughly taken as the equivalent of one guinea.

Report.

From the Hygienic Laboratories of the Royal Army Medical College.

EXPERIMENTS WITH PRESERVED MEAT.[1]

By Major W. W. O. BEVERIDGE, D.S.O., and Captain H. B. FAWCUS.
Royal Army Medical Corps.

A.—Experiments as to the Penetration of Heat into the Substance of the Meat in Tins during Sterilisation.

In order to ascertain, with any certainty, the temperature in the centre of the meat during sterilisation, it was found necessary to devise a special form of thermometer which would record accurately the variations of heat within the meat while the tin was hermetically sealed. We found that the usual method of inserting a thermometer through an open

[1] Being a Report to the Sub-Committee on Food of the War Office Committee on the Phsyiological Effects of Food, Training, and Clothing on the Soldier.

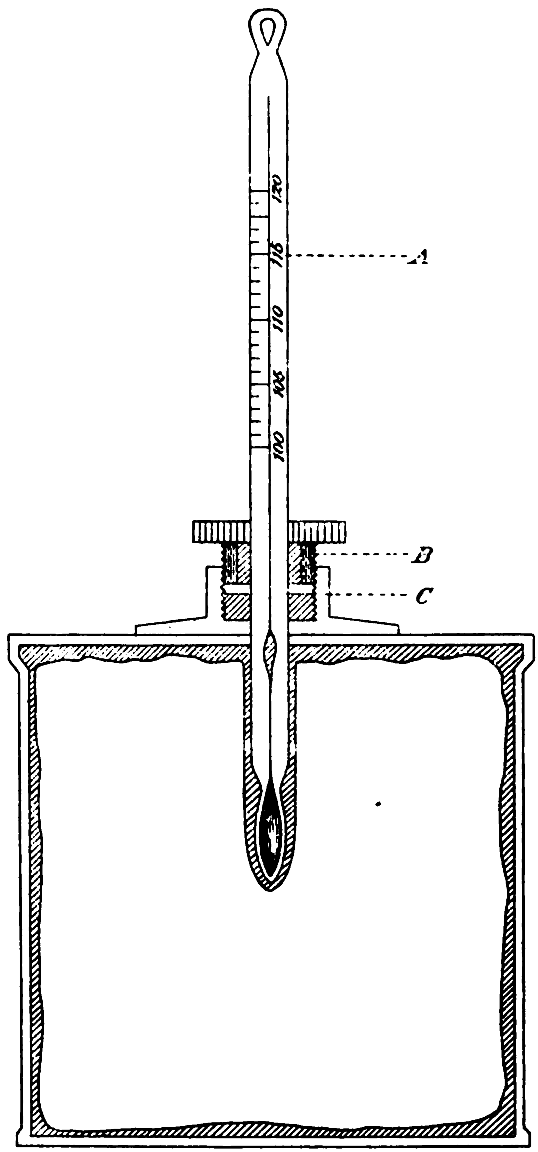

Diagram of the Special Thermometer *in situ.*

hole in the tin, would not simulate the conditions under which heat penetrated when a vacuum was present and the tin hermetically sealed, these being the conditions under which the tins are sterilised by the manufacturers. The following is a description of the special thermometer used, which we found to be in all respects satisfactory.

The thermometer A (see diagram) has a scale marked from 100° to 120° C., and is self-registering. This scale was chosen because the variations of temperature necessary for the experiments were included within it, and it was necessary to keep the thermometer within a convenient length. To ensure an air-tight joint the thermometer is made to pass through a brass shoulder C, and is kept in position by means of rubber and brass washers, which are tightened to any degree by means of the screw cap B. To use the thermometer, a hole is first drilled in the centre of one end of the tin of meat, and the brass shoulder is soldered securely on to the tin, covering the hole. The thermometer is then passed down into the meat, until its bulb lies exactly in the centre. The washers are passed over the thermometer and pressed down into the shoulder by means of the screw cap, which is then tightened, thus expanding the rubber washer and ensuring an absolutely air-tight union. In this way it is easy to record correctly the moment at which the centre of the meat reaches any temperature between 100° and 120° C., under precisely similar conditions to those which hold when the tins are sterilised commercially.

A series of experiments was carried out to show the rate of penetration of heat, using the above thermometer. The tins of meat used were selected from the new American supply. It is evident that for sterilisation the centre of the meat in the tin must reach at least 100° C., therefore temperatures below this point were not recorded. When a tin is simply boiled in water, we found by experiment that the temperature in the centre of the meat did not reach 100° C. in five hours. In order to obtain temperatures higher than this, we used a solution of calcium chloride, the boiling points of which varied as required between 107° C. and 130° C.

Experiment I.—To find the length of time necessary for the temperature in the centre of the meat to reach 100° C., or higher, when the hermetically sealed tin is immersed in fluid boiling at 107° C.

(*a*) A 1-lb tin of corned beef was placed in the boiling fluid. The thermometer in the centre of the meat registered as follows:—

100° C.	in 1 hour 18 minutes
102 ,, ...	,, 1 ,, 30 ,,

After removal from the boiling fluid the temperature reached 104° C.

(*b*) A 2-lb tin placed in fluid boiling at 107° C. under the same conditions. The thermometer in the centre of the meat registered:—

100° C.	in 1 hour 22 minutes
102 ,, ...	,, 1 ,, 29 ,,

After removal from the boiling fluid the temperature reached 104° C.

(*c*) A 1-lb. tin in fluid boiling at 107° C. Thermometer in centre registered :—

100° C.	in 1 hour 10 minutes
102 ,, ...	,, 1 ,, 16 ,,
105 ,, ...	,, 1 ,, 38 ,,
106 ,, ...	,, 2 ,,
107 ,, ...	,, 2 ,, 15 ,,

(*d*) A 2-lb. tin in fluid boiling at 107° C. Thermometer in centre registered :—

100° C.	in 1 hour 16 minutes
101 ,, ...	,, 1 ,, 21 ,,
102 ,, ...	,, 1 ,, 23 ,,
103 ,, ...	,, 1 ,, 33 ,,
104 ,, ...	,, 1 ,, 42 ,,
105 ,, ...	,, 1 ,, 58 ,,

106 ,, was not reached in three hours.

(*e*) A 2-lb. tin in fluid boiling at 107° C. Thermometer in centre registered :—

100° C.	in 2 hours 54 minutes
101 ,, ...	,, 2 ,, 59 ,,
102 ,, ...	,, 3 ,, 41 ,,

Note.—The meat in this tin was very closely packed.

(*f*) A 2-lb. tin in fluid boiling at 107° C. Thermometer in centre registered :—

100° C.	in 1 hour 36 minutes
101 ,, ...	,, 1 ,, 45 ,,
102 ,, ...	,, 1 ,, 51 ,,
103 ,, ...	,, 1 ,, 57 ,,
104 ,, ...	,, 2 ,, 5 ,,

Note.—It did not reach 105° in $2\frac{3}{4}$ hours. All these tins were markedly blown when removed from the fluid.

Experiment II.—The same samples, after removal from the fluid boiling at 107° C., were punctured to allow escape of steam, and immediately re-sealed, so as to cause as much of a vacuum as possible. They were then immersed in a fluid boiling at 120° C.

(*a*) A 1-lb. tin in fluid boiling at 120° C. Thermometer in centre registered :—

100° C.	in 34 minutes
102 ,, ...	,, 38 ,,
105 ,, ...	,, 44 ,,
110 ,, ...	,, 54 ,,
115 ,, ...	,, 1 hour 8 minutes

(*b*) A 2-lb. tin in fluid boiling at 120° C. Thermometer in centre registered :—

100° C.	in 34 minutes
105 ,, ...	,, 47 ,,
110 ,, ...	,, 55 ,,
115 ,, ...	,, 1 hour 10 minutes

(*c*) A 1-lb. tin in fluid boiling at 120° C. Thermometer in centre registered :—

100° C.	,, 18 minutes
105 ,, ...	,, 24 ,,
110 ,, ...	,, 30 ,,
115 ,, ...	,, 42 ,,

Note.—This tin had a small hole in the solder, and steam escaped during heating.

(*d*) A 2-lb. tin in fluid boiling at 120° C. Thermometer in centre registered :—

100° C.	in 13 minutes
103 ,, ...	,, 14 ,,
104 ,, ...	,, 14½ ,,
105 ,, ...	,, 15 ,,

(*e*) A 2-lb. tin in fluid boiling at 120° C. Thermometer in centre registered :—

100° C.	in 57 minutes
105 ,, ...	,, 1 hour 7 minutes
110 ,, ...	,, 1 ,, 22 ,,
115 ,, ...	,, 1 ,, 35 ,,

Note.—The meat in this tin was very tightly packed.

(*f*) A 2-lb. tin in fluid boiling at 120° C. Thermometer in centre registered :—

100° C.	in 24 minutes
105 ,, ...	,, 25 ,,
110 ,, ...	,, 27½ ,,
115 ,, ...	,, 36 ,,

Experiment III.—A 1-lb. tin in fluid boiling at 115° C. Thermometer in centre registered :—

100° C.	in 39 minutes
105 ,, ...	,, 45 ,,
110 ,, ...	,, 54 ,,
113 ,, ...	,, 75 ,,

Experiment IV.—(*a*) A 2-lb. tin in fluid boiling at 130° C. The thermometer in centre registered :—

100° C.	in 13 minutes
105 ,, ...	,, 18 ,,
110 ,, ...	,, 23 ,,

The temperature did not rise above 110° C. in 2 hours 20 minutes.

(*b*) A 2-lb. tin in fluid boiling at 130° C. The thermometer in centre registered :—

100° C.	.. ..	in 22 minutes
105 ,,	.. ..	,, 26 ,,
110 ,,	.. ..	,, 32 ,,
115 ,,	.. ..	,, 39 ,,
117 ,,	.. ..	,, 52 ,,

Similar experiments were carried out, with other tins, the results of which are recorded in the following table :—

TABLE I.

Size of tin	Temperature of bath	Rate of Penetration in Minutes								
		100°	101°	102°	103°	104°	105°	110°	115°	117°
1 lb.	107° C.	39	42	46	49	52	60	..	..	..
,,	,,	40	44	47	52	58	62	..	..	..
,,	,,	66	73	81	89	94	100	..	..	..
,,	,,	70	..	76	..	..	98	..	..	..
,,	,,	78	..	90	..	..	..	..	..	..
Average	minutes	58·6	..	68	..	..	80	..	..	..
1 lb.	120° C.	17	..	..	..	..	22	29	38	..
,,	,,	18	..	..	..	..	22	32	35	..
,,	,,	18	..	..	..	..	24	30	42	..
,,	,,	24	..	..	..	..	25	27	36	..
,,	,,	34	..	..	..	..	44	54	68	..
Average	minutes	22·2	..	..	..	..	27·4	34·5	43·8	..
2 lbs.	107° C.	76	81	83	93	102	108	..	..	..
,,	,,	94	98	103	108	114	125	..	..	..
,,	,,	98	109	118	123	128	131	..	..	..
,,	,,	99	103	106	109	115	118	..	..	..
,,	,,	108	115	121	125	129	133	..	..	..
Average	minutes	95	101·2	106·2	111·6	117·6	123	..	..	..
2 lbs.	120° C.	15	..	..	..	..	20	27	39	..
,,	,,	15	..	..	..	..	21	29	44	..
,,	,,	19	..	..	..	..	26	35	47	..
,,	,,	34	..	..	..	..	47	55	70	..
,,	,,	57	..	..	..	..	67	82	95	..
Average	minutes	28	..	..	..	..	36·2	45·6	59	..
2 lbs.	130° C.	13	..	..	..	..	18	23	..	..
,,	,,	22	..	..	..	..	26	22	39	52

It will be seen on reference to the above table that when tins of meat of identical size and shape are immersed in fluid boiling at a certain temperature, there is considerable variation in the length of time required for the centre of the meat to reach a given temperature. The cause of this is somewhat uncertain. Each experiment was carried out in an identical manner, so that the cause must have been in the tins them-

selves. It is probable that the rate of penetration of the heat is influenced by the amount of fat present in the meat. The percentage amount of this is found to vary considerably in different tins. The fact of the meat being tightly or loosely packed, and the condition of the vacuum present, may also favour or retard the penetration of the heat.

B.—Bacteriological Investigation to Determine the Thermal Death Point, and the Optimum Temperature of Growth of the Organism Isolated, by Major C. E. P. Fowler, R.A.M.C.

The organism isolated by Major Fowler from blown tins of corned meat, referred to in a previous report to the Committee, is apparently identical with the *Bacillus cadaveris sporogenes* of Klein, and the *B. putrificus coli* of Bienstock. Upon further investigation it is found to have the following characters, which include those already given by Major Fowler :—

Morphology.—A bacillus which varies greatly in length, the average size being about 6 μ long by 0·6 μ broad. Ends rounded. Motile, with slow waving movement. Is usually seen with a large terminal oval spore. Stains with all the ordinary dyes, and retains the stain by Gram's method.

Growth.—It is a strict anaerobe. Sometimes it presents the appearance of growing aerobically in milk cultures. This is due to the scum forming on the surface of the milk, which converts it into an anaerobic culture. It grows slowly at all temperatures. The optimum temperature of growth is 37° C. It grows well at 42° C., but its growth at room temperature is extremely slow. Milk cultures kept at 17-22° C. rarely become decomposed in a month. Tubes of milk inoculated with the *B. cadaveris* were incubated at temperatures of 42° C., 37° C., and 22° C. The milk at the two higher temperatures became decomposed within seven days. That at 22° C. remained unchanged at the end of thirty-four days. At the end of that time it was transferred to a 37° C. incubator, when it became completely decomposed within four days. In all cultures it gives off an exceedingly putrid odour.

Agar Slope.—After three or four days at 37° C., there is a yellowish-brown growth, generally of discrete circular colonies, with irregular edges, which appear granular under a low power. At first few spores are formed, but later many appear.

Broth.—After about four days at 37° C., growth visible at the bottom of the tube as a fine granular deposit, the upper part of the medium being usually clear. Putrid odour.

Gelatin.—Slow softening after seven to nine days at 22° C. Colonies show filamentous offshoots. Later the gelatin becomes completely liquefied and the growth sinks to the bottom, leaving the upper part of the medium clear.

Litmus Milk.—After four or five days at 37° C. the milk is decolorised and sometimes clotted. Later slow digestion of the casein takes place, leaving a clear yellow whey. No gas is formed. When the culture is exposed to the air and shaken, the upper layers of the medium become bluish-red. The milk is completely digested in from seven to fourteen days, leaving merely a granular deposit at the bottom of the tube.

Neutral Red Glucose-agar.—After about three days at 37° C. there is free gas formation, and the red colour becomes reduced to a bright yellow.

One per cent. Glucose-peptone.—Strong growth; moderate amount of gas is formed, and slight acidity; few spores.

One per cent. Lactose-peptone.—Feeble growth; no gas; no acid; few spores.

One per cent. Sucrose-peptone.—Feeble growth; very slight formation of gas and acidity; few spores.

One per cent. Mannite-peptone.—Growth, but no gas or acid; few spores.

Nitrate Broth, one per cent.—No reduction to nitrites.

MacConkey's Bile Salt Broth.—Growth; acid but no gas.

Peptone and Salt.—Indol negative.

Effect on Animals.—The organism was found by Major Fowler to be non-pathogenic to guinea-pigs when injected hypodermically and intra-peritoneally. Feeding experiments have, however, not yet been carried out.

Chemical Action.—Tissier and Martelly (*Annal. Inst. Pasteur*, September 25th, 1902) found that the action of the bacillus was paralysed by a 1·75 per cent. acidity, reckoned as H_2SO_4. It was found that different strains of the organism varied considerably in their activity in the various media. The organism shows the greatest activity in the presence of pure proteid matter, which it attacks with avidity, forming abundance of gas, with an exceedingly putrid odour. On analysis this gas was found to consist of over 50 per cent. of carbon dioxide, together with considerable quantities of hydrogen sulphide and some hydrogen. Methane and methyl mercaptan were also present. The exceedingly putrid odour of the gas is evidently due to the presence of hydrogen sulphide and methyl mercaptan.

All the tins of decomposed meat examined showed a decided increase of the acidity over that normally present in sound tins. This is undoubtedly due to the action of this bacillus. As before mentioned, its action is paralysed by acidity amounting to 1·75 per cent. This would explain the phenomenon, which is sometimes found, of a blown tin of meat being apparently sterile on examination.

Occurrence.—The bacillus is said to be a normal but not numerous inhabitant of the intestine of men and animals. Tissier and Martelly (*loc. cit.*) found this bacillus among others in every sample of fresh meat

which they obtained from the butcheries of Paris, so that the contamination of tinned meat would appear to take place in the slaughter-house, and during the manipulation necessary to the process of canning.

It is probable that this bacillus is of more wide-spread occurrence than is usually supposed, as we have evidence that it is present in many samples of milk. For instance, two samples of fresh milk received from a neighbouring dairy, on prolonged incubation at 37° C., after boiling to destroy non-spore-bearing bacteria, became decomposed, and on examination this bacillus was found.

Thermal Death Point.

To ascertain this, the following experiments were carried out:—

Series I.

(1) Milk cultures of this bacillus were sealed in small glass capsules, containing about 0·2 cc. These were then suspended in a wire cage in a solution kept boiling at 100° C.

No. 1 capsule in the fluid at 100° C. for	5 minutes
,, 2 ,, ,, ,, ,, ...	10 ,,
,, 3 ,, ,, ,, ,, ...	15 ,,
,, 4 ,, ,, ,, ,, ...	20 ,,
,, 5—Control capsule at laboratory temperature.	

Each capsule, on being taken out of the fluid, was dropped into cold water. It was then opened, the contents inoculated into tubes of neutral red glucose-agar and litmus milk, and incubated anaerobically at 37° C. At the end of forty-eight hours all neutral red agar tubes, and at the end of four days all milk tubes, gave a typical reaction. The *B. cadaveris* was recovered from all the milk tubes. *Therefore* B. cadaveris *spores can survive a temperature of* 100° *C. for twenty minutes.*

(2) Four tubes of neutral red glucose-agar were inoculated with an agar culture of *B. cadaveris* (bacilli and spores), and then placed in a solution boiling at 100° C.

No. 1 tube for	10 minutes
,, 2 ,, ...	20 ,,
,, 3 ,, ...	30 ,,
,, 4 ,, ...	40 ,,

On being removed from the fluid each tube was cooled rapidly under the tap, and incubated anaerobically at 37° C. At the end of forty-eight hours all tubes gave a typical reaction and the bacillus was recovered. *Therefore* B. cadaveris *spores can survive a temperature of* 100° *C. for forty minutes.*

For further experiments in the thermal death-point, an emulsion of *B. cadaveris* was made thus:—

A 4 per cent. emulsion of dried human fæces in water was made and sterilised. To 100 cc. of this, several milk cultures of *B. cadaveris* were

added, thus making a rich emulsion of the organism in a fluid containing natural organic matter, simulating more or less the conditions in which it occurs in nature. This is referred to in future as the "cadaveris-fæces" emulsion.

(3) Four glass capsules of cadaveris-fæces emulsion were placed in fluid boiling at 100° C.

No. 1 capsule for	30 minutes
,, 2 ,, ...	45 ,,
,, 3 ,, ...	60 ,,
,, 4 ,, ...	75 ,,

The capsules were cooled as before, and the contents inoculated into litmus milk and neutral red glucose-agar tubes. Typical reactions were obtained in all tubes within seven days, and the bacillus was recovered. *Therefore* B. cadaveris *spores can survive* 100° *C. for one and a quarter hours.*

(4) An emulsion from an agar slope of *B. cadaveris* was sealed in a small glass capsule, and suspended in a solution, boiling at 110° C., for two minutes. The capsule was cooled and contents inoculated as before. A typical reaction occurred, and the bacillus was recovered from the tubes. *Therefore* B. cadaveris *spores can survive a temperature of* 110° *C. for two minutes.*

(5) An emulsion from an agar slope was sealed in a small glass capsule, and suspended in a solution, boiling at 110° C., for three minutes. After cooling the contents were inoculated into neutral red agar and litmus milk tubes as before. A typical reaction was obtained in both tubes and the bacillus was recovered. *Therefore* B. cadaveris *spores can survive a temperature of* 110° *C. for three minutes.*

(6) Four glass capsules of cadaveris-fæces emulsion were placed in fluid boiling at 110° C.

No. 1 capsule for	3 minutes
,, 2 ,, ...	5 ,,
,, 3 ,, ...	7 ,,

Capsules cooled and contents inoculated as before. A typical reaction was obtained in the cultures and the bacillus was recovered. *Therefore* B. cadaveris *spores can survive a temperature of* 110° *C. for seven minutes.*

(7) Five capsules of cadaveris-fæces emulsion were immersed in fluid boiling at 110° C.

No. 1 capsule for	5 minutes
,, 2 ,, ...	10 ,,
,, 3 ,, ...	15 ,,
,, 4 ,, ...	20 ,,
,, 5 ,, ...	30 ,,

Capsules cooled and contents sown into neutral red agar, litmus milk and broth. All tubes gave a typical reaction and the bacillus was

recovered. *Therefore* B. cadaveris *spores can survive a temperature of* 110° *C. for thirty minutes.*

(8) Three small glass capsules of cadaveris-fæces emulsion were immersed in fluid boiling at 110° C.

No. 1 capsule for	.. ..	30 minutes
,, 2 ,,	.. ..	45 ,,
,, 3 ,,	.. ..	60 ,,

The capsules were then cooled and contents inoculated as before. Cultures from all three capsules showed typical reactions and the bacillus was recovered. *Therefore* B. cadaveris *spores can survive a temperature of* 110° *C. for sixty minutes.*

(9) Six capsules of cadaveris-fæces emulsion, as above, were immersed in fluid boiling at 112° C.

No. 1 capsule for	.. ..	5 minutes
,, 2 ,,	.. ..	10 ,,
,, 3 ,,	.. ..	15 ,,
,, 4 ,,	.. ..	20 ,,
,, 5 ,,	.. ..	25 ,,
,, 6 ,,	.. ..	30 ,,

The capsules were then cooled and contents sown as before. Cultures from capsules Nos. 1, 2, 3, and 4 gave typical reactions, and the bacillus was recovered from them. Cultures from 5 and 6 remained sterile. *Therefore the* B. cadaveris *spores can survive a temperature of* 112° *C. for twenty minutes, but are killed by the same temperature in twenty-five minutes.*

(10) Three capsules of cadaveris-fæces emulsion, as above, were immersed in fluid boiling at 115° C.

No. 1 capsule for	.. ..	5 minutes
,, 2 ,,	.. ..	10 ,,
,, 3 ,,	.. ..	15 ,,

Cultures from No. 1 gave typical reactions. Cultures from Nos. 2 and 3 remained sterile. *Therefore* B. cadaveris *spores can survive a temperature of* 115° *C. for five minutes, but are killed by the same temperature in ten minutes.*

(11) Capsules of cadaveris-fæces emulsion, as above, were immersed in fluid boiling at 117° C.

No. 1 capsule for	.. ..	5 minutes
,, 2 ,,	.. ..	10 ,,

The capsules were cooled and contents sown as before. All the cultures from these capsules remained sterile. *Therefore* B. cadaveris *spores are killed by a temperature of* 117° *C. in five minutes.*

From these eleven experiments it would appear that the spores of this bacillus are only killed by a temperature of 112° C. in twenty-five minutes, 115° C. in ten minutes, or 117° C. in less than five minutes. The results of the foregoing experiments are embodied in the following table:—

TABLE II.

EXPERIMENTS WITH GLASS CAPSULES OF CADAVERIS-FÆCES EMULSION, SHOWING MINUTES REQUIRED TO KILL *B. cadaveris* SPORES WHEN EXPOSED TO CERTAIN TEMPERATURES.

TEMPERATURE	Minutes								
	5	10	15	20	25	30	45		75
100° C.	+	+	+	+	+	+	+	+	+
110 ,,	+	+	+	+	+	+	+	+	
112 ,,	+	+	+	+	−	−			
115 ,,	+	−	−						
117 ,,	−	−							

\+ Spores survived. − Spores killed.

Series II.—Experiments with Tins of Compressed Meat Inoculated with the Spores of B. cadaveris.

Experiment I.—A 1-lb. tin (tin "A") of corned beef was inoculated with an agar emulsion of *B. cadaveris* (one-month-old culture) thus: A hole was bored in the tin and about 0·5 cc. of the cadaveris-fæces emulsion was injected into the centre of the meat with a sterile pipette. The hole was then soldered up, and the tin placed in a fluid boiling at 100° C. for thirty minutes. It was then cooled and incubated at 37° C. for sixteen days. At the end of this time the tin was not blown, and on puncturing there was no escape of gas. Gas had not escaped, as the sides and top remained concave. On opening the tin the meat was not discoloured or decomposed, but some of the fæces appeared to be somewhat digested. There was no apparent bad smell. The acidity mounted to 0·81 per cent. as lactic acid. Some of the contents, both meat and liquid, were sown into litmus milk, neutral red agar and broth tubes. All tubes gave a typical reaction, and the bacillus was recovered in three days.

Result.—*B. cadaveris* recovered from a tin of meat after exposure to a temperature of 100° C. for thirty minutes.

Note.—As already shown in the first part of this report, the temperature in the centre of the meat had not reached 100° C.

Experiment II.—A 1-lb. tin of corned beef (tin "B") was inoculated in the same way as in the above experiment and re-sealed. The tin was then placed in fluid boiling at 107° to 108° C. for thirty minutes. It was then punctured to relieve pressure, and re-soldered, cooled, and incubated at 37° C. At the end of fifteen days the tin was very much distended with gas. On opening there was a strong rush of gas with a very putrid odour. A good deal of turbid fluid escaped. The meat was not discoloured, but was softened, and the fibres separated by gas. The acidity was 0·81 per cent. as lactic acid. Cultures were made from both the juice and the meat and a typical reaction obtained, and the bacillus was recovered from all the tubes.

Result.—The *B. cadaveris* was recovered alive from a tin of meat which had been exposed to a temperature of 107° C. for thirty minutes.

Note.—On reference to the first part of this report it will be noticed that the temperature in the centre of the meat did not reach 100° C. in this period of time.

Experiment III.—A small tin of about 2-ounce capacity (tin "C") was tightly packed with corned beef and inoculated with cadaveris-fæces emulsion. The special thermometer was sealed into it. It was then immersed in fluid boiling at 110° C. The thermometer registered :—

100° C.	in 15½ minutes
105 ,, ...	,, 18¾ ,,
110 ,, ...	,, 25 ,,

The tin was taken out after fifty minutes. It was then cooled, opened, and the whole of its contents were placed in two large sterile test tubes and incubated anaerobically at 37° C. After six days there was commencing gas formation with putrid smell. Cultures made from the meat showed typical reactions and the bacillus was recovered.

Result.—*B. cadaveris* spores can survive a temperature of 110° C. for twenty-five minutes.

Experiments IV. and V.—Two 1-lb. tins of corned beef (tins "D" and "E") were inoculated in the same manner as above with about 1 cc. of cadaveris-fæces emulsion. In one tin (E) the special thermometer was sealed with the bulb in the centre of the meat. Both tins were then immersed in fluid boiling at 115° C. It was assumed in this experiment that the temperature in tin D would be the same as that registered by the thermometer in tin E. The thermometer in tin E registered :—

100° C.	in 39 minutes
105 ,, ...	,, 45 ,,
110 ,, ...	,, 54 ,,
112 ,, ...	,, 63 ,,
113 ,, ...	,, 75 ,,

The tin without the thermometer (D) was removed from the fluid after sixty minutes, the temperature in the tin E being 111·5° C. It was punctured to relieve pressure and immediately re-sealed. It was then placed in cold water for one hour, when the sides of the tin became distinctly concave. The tin was then incubated at 37° C. In seven days the tin was much distended by gas. On opening it there was a rush of evil-smelling gas. Cultures made from both the meat and the juice gave typical reactions. A loopful taken from the juice showed on examination numerous bacilli and spores.

Result.—*B. cadaveris* was recovered from a tin which had been exposed to a temperature of 115° C. for one hour.

Note.—From comparison with the tin E the centre of the meat had probably been exposed to a temperature of 100° C. and over for twenty-one minutes, 110° C. and over for six minutes, and 111·5° C. momentarily.

Tin E.—The tin which contained the thermometer (E) was removed

from the fluid after seventy-five minutes, the temperature in the centre of the meat being 113° C. This tin was treated in exactly the same manner as tin D. At the end of thirteen days this tin showed no signs of blowing. When punctured under water, the water was sucked in, showing that a vacuum still remained. On opening the tin there was no smell and the meat appeared to be sound. Cultures were made both from the meat and juice, and portions of the meat were also incubated anaerobically in broth. No reaction was obtained in any of the tubes, and the meat appeared to be sterile. The acidity in this case was only 0·45 per cent. as lactic acid, which is the normal percentage of acidity found in sound tinned meats.

Result.—*B. cadaveris* was not recovered from a tin of corned meat after exposure to a temperature of 115° C. for seventy-five minutes.

Note.—The supposition is that the spores of this bacillus had been killed by a temperature of 112° C. to 113° C. for twelve minutes, as we know that temperatures below this do not kill them.

Experiments VI. and VII.—Two 1-lb. tins of corned beef (tins "F" and "G") were inoculated with about 1 cc. of cadaveris-fæces emulsion. Into tin G the special thermometer was sealed, with the bulb in the centre of the meat. Both tins were then immersed in fluid boiling at 120° C. The thermometer in tin "G" registered:—

100° C.	.. ..	in 24 minutes
105 ,,	.. ..	,, 25 ,,
110 ,,	.. ..	,, 27½ ,,
115 ,,	.. ..	,, 36 ,,

Tin F was removed from the fluid after thirty-one minutes, the temperature in tin G being 112.5° C. After being punctured, re-sealed and cooled, it was incubated at 37° C. After thirteen days the tin showed no signs of blowing. On being punctured under water, the water was sucked in. On opening, the meat appeared sound and had no bad smell. Acidity, 0·72 per cent. as lactic acid. Cultures made from the juice and meat showed typical reactions, and the bacillus was recovered from all the tubes.

Result.—*B. cadaveris* was recovered from a tin which had been exposed to a temperature of 120° C. for thirty-one minutes.

Note.—From comparison with tin G the centre of the meat had probably been exposed to a temperature of 112.5° C. momentarily.

Tin G.—Tin G was removed from the fluid after thirty-six minutes, the temperature in the meat, as registered by the thermometer, being 115° C. It was treated in exactly the same manner as tin E. After fourteen days' incubation the tin was slightly blown, and some gas escaped on puncture under water. The meat was not decomposed. Cultures made from the meat and juice all showed typical reactions, and the bacillus was recovered from all the tubes.

Result.—*B. cadaveris* was recovered from a tin of corned meat which had been exposed to a temperature of 120° C. for thirty-six minutes.

Note.—The centre of the meat, as shown by the thermometer, had been exposed to a temperature of 112° C. and over for five minutes, and 115° C. momentarily.

These seven experiments with inoculated tins would tend to show that the spores of this bacillus can survive a temperature of 112° C. for five minutes, but are killed by a temperature of 112° C. for twelve minutes. On the contrary, the eleven experiments with glass capsules described above show that the spores can survive a temperature of 112° C. for twenty minutes, but are killed by the same temperature in twenty-five minutes. These latter experiments show that the actual thermal death point of the spores is a temperature of 112° C. acting for from twenty to twenty-five minutes, or 115° C. acting for from five to ten minutes. The discrepancy in the length of time apparently required to kill the spores in the experiments with tins of meat and those with glass capsules can be explained by the fact that the temperature in the centre of a tin of meat would remain at 112° C., or over, for some time after the tin was removed from the fluid. This is not the case with the glass capsules, therefore the results obtained by using them are more likely to be accurate. It is also probable that the spores are killed immediately by a temperature of 117° C.

General Conclusions.

(*a*) The bacillus under consideration, although non-pathogenic to animals, decomposes tinned meats and renders them quite unfit for consumption. Therefore processes of sterilisation of tins of meat must be used which will destroy the spores of this bacillus. The optimum temperature of growth of this bacillus is blood heat (37° C.). At this temperature inoculated tins of meat become rapidly decomposed, but this decomposition is not necessarily made apparent at once by the presence of gas in the tin. Blowing of the tins often does not take place within a fortnight, even at this temperature. Tins of meat contaminated with the spores of this bacillus could be kept at temperatures of 22° C. and under for many months, without showing any signs of blowing. If, however, such contaminated tins, although apparently sound when examined in this country, were exposed to a temperature such as is likely to be met with in the Tropics, they would rapidly become decomposed.

(*b*) The rate of penetration of heat into the substance of the meat in tins during sterilisation is extremely variable. We have based our conclusions on the average of many experiments. To ensure complete sterilisation, the temperature of the medium surrounding the tins must always be above 112° C. The lowest temperature of the surrounding fluid which will completely sterilise the tins within a reasonable time is 120° C., and this temperature must act for not less than sixty minutes. From the two experiments recorded with a fluid boiling at 130° C., it

would appear that even then at least an hour would be required to ensure the death of these very resistant spores. We are aware that the above results do not tally with the usually accepted idea of the thermal death point of spore-bearing bacilli, but we would point out that experiments have not before, to our knowledge, been made with this particular bacillus. The experiments were carried out with every available precaution against error, and repeated often enough to ensure accuracy.

Reviews.

For more extended Review see page 635

THE THEORY AND PRACTICE OF HYGIENE (Notter and Firth), revised and largely rewritten by Lieutenant-Colonel R. H. Firth, R.A.M.C. Third Edition. London: J. and A. Churchill, 1908. 993 pp. quarto. Price 21s. net.

The appearance of the third edition of this standard and monumental work will be hailed with satisfaction on all sides. Colonel Firth has spared no pains to bring his book thoroughly up to date, and in fact, the letterpress is very largely quite new. The chapters most extensively modified are those dealing with water, food, habitations, removal and disposal of sewage, disposal of the dead, offensive trades, parasites, infectious diseases, disinfection, vital statistics, and last, but not least, military hygiene. The last chapter runs to sixty-two pages, and contains much new and interesting information, among which we note a full description, with a photograph, of the new Slack and Brownlow watercart that gave some of us so much trouble on manœuvres last summer.

As the subject of public health is now of such vital importance in the Army, we strongly recommend every officer of the Royal Army Medical Corps to procure a copy of Colonel Firth's book.

A. I. F.

THE BACTERIOLOGICAL EXAMINATION OF DISINFECTANTS. By William Partridge, F.I.C. London: Sanitary Publishing Co., 1907. 2s. 6d. net.

This is a little book of some seventy pages, giving a clear and intelligible description of the methods of conducting an examination of a disinfectant by bacteriological testing. The requisites of a true disinfectant are set forth; the fallacy of chemical methods of testing, as a practical guide to disinfectant value, is explained; and an account of the bacteriological procedure, according to the Rideal-Walker method, is given in detail, with illustrations of the apparatus required. The last two chapters describe the modifications that have been suggested in this method, viz., the use of sterile urine by Klein; of milk by Meredith, Wynter Blyth; of gelatin, mucin, &c., by Sommerville and Walker; and the two other processes, similar in principle, but different in technical details of procedure, viz., the "garnet" method and the "thread"

method. Of the former "the results are too irregular to justify its adoption as a means of obtaining any comparative figure of disinfecting efficiency" (Firth and Macfadyen): of the latter, the Royal Sanitary Institute Committee consider "the technique to be so elaborate that, no matter what may be its merits, its adoption as a standard procedure seems impossible."

Although the author is evidently strongly in favour of the particular standardising process that he describes and recommends, his statements are quite fair and unprejudiced with regard to the other methods. Major C. E. P. Fowler, R.A.M.C., contributes a short preface, summing up with the following advice to anyone reporting on the efficiency of a disinfectant: "Ascertain the value by the 'Rideal-Walker' method against a pure culture, making the dilutions with distilled water; then confirm this value by carrying out the same technique, but employing one or two per cent. of some solid organic material in making the dilutions as recommended in the Sommerville-Walker modification of the test."

The book will be useful to anyone having to deal with, and wishing to understand the action of, chemical disinfectants.

A. M. D.

The Pocket Anatomy. Edited by C. H. Fagge, M.B., M.S., F.R.C.S.Eng. London: Baillière, Tindal and Cox, 1908. Sixth Edition. Thirtieth Thousand. 269 pp. octavo. Price 3s. 6d. net.

This is our old friend "The Pocket Gray" under a new guise. We cannot help regretting the change of a name which is a cherished memory with so many a disciple of Æsculapius. As good wine needs no bush, so this well-known cram-book needs no praise. Its reputation is old and well-established. In our opinion it is by far the best "tabloid" anatomy in the market. From personal experience we can strongly recommend it to all who are preparing for an examination in anatomy. In the words of Bulloch (not the eminent pathologist):—

"What '*Bohn*' is to the neophyte in Arts,
What keys are to the mathematic dolt,
What spurs are to the trainer when he starts
The breaking of a dilatory colt;
This book is to the medical who smarts,
While grappling with anatomy's array;
Need I tell you that the title of this *vade mecum* vital
Is the famous and familiar 'Pocket Gray'?"

A. I. F.

Fevers in the Tropics: Their Clinical and Microscopical Differentiation, including the Milroy Lectures on Kala-azar. By Leonard Rogers, M.D., F.R.C.P., F.R.C.S.Eng., I.M.S., Professor of Pathology, Calcutta Medical College. London: Henry Frowde, Oxford University Press, and Hodder and Stoughton, 1908. 343 pp. quarto. Price 30s. net.

The appearance of this scholarly and exhaustive, yet most readable work on tropical fevers, will be eagerly welcomed by every student of tropical medicine. Besides putting the classical knowledge of the diseases treated of in a clear and intelligent form, Major Rogers has included in his valuable book a vast amount of original work, the result of pro-

longed and arduous personal investigation of many forms of oriental disease. We note specially the admirable manner in which the subject-matter is arranged and tabulated, thus greatly facilitating reference, a most important point in a work of this description. A specially interesting chapter is that dealing with "unclassified short fevers." The differential diagnosis of "seven-day fever" from dengue is very clearly put. We recommend Major Rogers's book to all who require a work of reference on tropical fevers.

A. I. F.

AIDS TO SURGERY. By Joseph Cunning, M.B., B.S., F.R.C.S.Eng. Second Edition. London: Baillière, Tindal and Cox, 1908. 404 pp. octavo. Price 4s. net.

We welcome the second edition of this admirable little book. It has been revised and brought thoroughly up to date. The sections on gall-stones and diseases of the pancreas have been entirely rewritten. We have no hesitation in strongly recommending this *multum in parvo* to all those who have the misfortune to be going up for an examination in surgery. Our Royal Army Medical Corps Captains ought to find it a friend in need, during the six months of intellectual struggle before their majority examination. We cannot describe Mr. Cunning's book better than by saying that it is a pocket "Rose and Carless." Any man who knows it from board to board will get his "Special."

A. I. F.

THE ROTUNDA PRACTICAL MIDWIFERY. By E. H. Tweedy, M.D., F.R.C.P.I., and G. T. Wrench, M.D. 464 pp. quarto. London: Henry Frowde, and Hodder and Stoughton, 1908. Price 16s. net.

This is a practical book on midwifery, embodying the teaching of the Rotunda school. It contains no pathology or mechanics of obstetrics, except where essential for understanding proposed treatment. The conduct of normal labour is dealt with, and the closest attention given to every practical detail, however small.

The book forms an admirable guide for men beginning obstetric work, and who want the essential steps of procedure fully and clearly stated.

A. I. F.

BLOOD EXAMINATION AND ITS VALUE IN TROPICAL DISEASE. By Claud F. Fothergill, M.R.C.S., L.P.C.P., B.A., M.B., B.C.(Cantab.). London: Henry Kimpton. 34 pp. octavo. Price 2s. 6d. net.

This little book aims at giving an account of the blood conditions in the chief tropical diseases. In our opinion its value as a handbook is much diminished by a complete absence of any headings or tabulation. We quite agree with the author that it is "best to refer seriatim to various tropical diseases rather than make several subdivisions according to changes in the appearance and number of the corpuscles," which involves frequent repetition and overlapping. At the same time we consider that each disease should be clearly marked by a new heading, and that the blood-changes in each case should be tabulated on some common system. In these days of steam and strenuosity one cannot

afford to wade through half-a-dozen pages looking for some particular disorder or symptom.

The most interesting part of the book is a series of thirty cases of various tropical ailments, extracted from the Reports of the Seamen's Hospital, recorded with special reference to the blood condition in each.

A. I. F.

Current Literature.

Precautions for the Prevention of Enteric Fever in the French Army.—A comprehensive circular has just been issued by the French War Office, and published in the *Journal Officiel de la Republique Française* of January 14th, 1908, on the subject of the prevention of enteric fever in the Army. It commences by drawing attention to the excessive incidence of enteric fever in the French Army; and states that the disease is more frequent in the Army than among the civil population, and is, along with tuberculosis, the principal cause of death. The lowest record was in 1902, and even then the admission-rate among the home troops was 3·79 per 1,000 and the death-rate 0·52 per 1,000.

Attention is drawn to the importance of water supplies in spreading the disease, to the conveyance of the germ from man to man by fæces or urine, and also by less commonly recognised conditions, such as atypical gastro-intestinal inflammations, gastric fevers, bronchitis and broncho-pneumonia, indefinite febrile conditions, ordinary diarrhœa, sore throats, affections of biliary ducts, slight renal inflammations, appendicitis and recurring otitis. Enteric dissemination from these affections, the circular states, is commoner than is supposed.

Reference is made to a report by Medécin-inspecteur Vaillard, who was instructed to investigate the subject. This report has been approved by the Advisory Committee on military hygiene and epidemiology, and the following prophylactic measures are in future to be carried out in the Army:—

(1) General sanitary precautions in cases of infectious disease, viz., prompt admission of the patient to hospital, isolation and observation of suspects; observation of men occupying adjoining beds in barracks and frequent medical inspections; disinfection of excreta, bedding, clothing, linen and infected localities; scrupulous cleanliness and disinfection of latrines, urinals and their vicinity, &c.

(2) Careful supervision of water-supplies of all kinds, and lectures &c., to the men on the risk of drinking non-potable water in or out of barracks.

(3) Supervision of milk supplies.

(4) Washing vegetables intended to be eaten uncooked, in running water; and prohibition of the eating of uncooked vegetables during prevalence of epidemics.

(5) Retention of cases of enteric fever in hospital till bacteriological examination of the stools and urine show them to be free from Eberth's bacillus. Should a patient be given convalescent furlough while still carrying Eberth's bacillus, he is to be specially warned of the risk to

which he exposes others, and written instructions are to be given him informing him of the measures to be taken to avoid endangering others. When a soldier returns from convalescent furlough he is to be examined to see whether he is free from Eberth's bacillus or not. If not, he is to be again sent away on furlough. Under some circumstances a man may continue to be the carrier of the bacillus for several years. In such a case the question of his being invalided from the Army is to be considered.

(6) No soldier who has been a patient from enteric fever is to be employed, after his return to duty, in the kitchen, mess or canteens—anywhere, in fact, where he handles the men's food.

(7) When enteric fever is epidemic or endemic in a regiment or locality, careful attention must be paid to atypical forms of infection. Any soldier showing symptoms of an indefinite disease, must be regarded as being infected by Eberth's bacillus and submitted to a minute examination by sero-diagnostic methods, blood cultures, and bacteriological examination of stools. Such patients are to be treated in the same way and submitted to the same supervision after recovery as typical enteric patients.

(8) Men occupying beds in barracks adjoining the bed occupied by an enteric case are to be carefully examined and watched, even if they appear to be in robust health.

(9) When successive cases of enteric fever occur in the midst of healthy men, the latter are to be suspected of harbouring the bacillus, and their stools and urine must be bacteriologically examined.

(10) When enteric fever is prevalent in a regiment at the time of embodying the annual contingent of recruits, the postponement of their embodiment or the transfer of the recruits to another garrison will be considered, according to circumstances. When there are only a few isolated cases, the recruits will be embodied but kept together in separate barrack rooms, with separate latrines, kitchens, &c. These precautions will cease twenty days after the occurrence of the last case of enteric fever in the unit. At the time of embodiment medical officers will closely enquire into the antecedent medical history of each recruit, and, should he have recently had an attack of enteric fever, will proceed to examine his excreta bacteriologically.

(11) Previous to manœuvres, the area over which these are to take place, and the localities where troops will be billetted or cantonned, will be carefully inspected by a military medical officer appointed for the purpose. He will examine water-supplies, including private and public wells, and will indicate such as are to be prohibited from being used by the troops; he will report upon the usual state of health of the locality, on actual or recent existence of enteric fever or other infectious disease, and on quarters or houses which have been infected and which must be avoided. The general officer commanding must take this report into account in selecting cantonments, and must keep himself informed as to any change in their sanitary condition between the time of the report and their actual occupation.

W. G. M.

The Army Medical Department in the Indian Mutiny.—In the *Indian Medical Gazette* for January, 1908, Lieutenant-Colonel D. G.

Crawford, I.M.S., contributes an interesting paper on the Medical Services in the Mutiny.

The Army Medical Department won three Victoria Crosses in the Mutiny: Surgeon (afterwards Surgeon-General and C.B.) Herbert Taylor Reade at the storming of Delhi, September 14th and 16th, 1857; Surgeon (afterwards Inspector-General and C.B.) Joseph Jee, at the first relief of Lucknow, September 25, 1857; and Surgeon (afterwards Surgeon-General and K.C.B.) Anthony Dickson Home, at the first relief of Lucknow, September 26th, 1857. It is interesting to note in this connection that the Army Medical Department also gained three Victoria Crosses in the Crimea. These were won by Surgeon (afterwards Surgeon-General and K.C.B.) J. Mouat, at the battle of Balaklava, October 26th, 1854; Assistant-Surgeon (afterwards Surgeon-Major) T. E. Hale, September 8th, 1855; and Assistant-Surgeon H. W. T. Sylvester, September 8th, 1855.

Among officers of the Army Medical Department who fell in the course of the Mutiny were Assistant-Surgeon S. Moore, who was killed by the mutineers at Delhi, and Surgeon Stack, who was shot at the storming of Jhansi; Surgeon J. H. Ker-Innes and Assistant-Surgeon S. A. Lithgow were both wounded at the siege of Delhi. The former, as also Assistant-Surgeon J. J. Clifford, were mentioned in despatches by General Wilson for their conduct during this siege, while Assistant-Surgeon Boyd was mentioned in despatches by Brigadier Inglis for distinguished conduct at the siege of Lucknow.

A. I. F.

Treatment of Sleeping Sickness.—In *Archivos de Hygiene e Pathologia Exoticas* for November 30th, 1907, Professor Kopke, of the Lisbon Tropical School, gives a number of instructive cases of atoxyl treatment. He concludes that if the trypanosomes have once entered the sub-arachnoid space, atoxyl never effects a cure, though it may produce considerable temporary improvement. Though the trypanosomes disappear from the blood, they persist in the cerebro-spinal fluid and give rise to relapses. The author considers that the parasites develop atoxyl-tolerance. In this way atoxyl may be a positive danger if used extensively with a view to prophylaxis, by creating a race of atoxyl-fast trypanosomes, which may be spread broadcast through a community, none of the patients in such a case being amenable to the drug.

Of twenty-nine cases treated, twenty-one had died up to the date of writing. Seven died soon after treatment was commenced; the others lived from five months to one year and nine months after the first injection of atoxyl. The usual dose was 20 m. of a 1 per cent. solution of atoxyl. Doses of 10 m. of a 0·5 per cent. solution of anilin green, and 10 m. of a 0·75 per cent. solution phenyl-urate, were in some cases injected into the spinal canal, without any particular result. A. I. F.

Transmission of Sleeping Sickness by Sexual Intercourse.—In *Archiv für Schiffs-und Tropen-Hygiene*, part ii., 1908, Staff-Surgeon R. Kudicke, of the German East African Protectorate troops, brings forward some interesting additional evidence with regard to Koch's suggestion as to the transmission of *Trypanosoma gambiense* by sexual intercourse. (See this Journal for December, 1907). Dr. Kudicke was placed in charge of the Sleeping Sickness Camp at Kisiba in May, 1907. Up to September

1st, 1907, 376 patients had been treated, most of whom had resided for long periods in infected localities. Investigations made with a view to discovering cases of sleeping sickness among the population of Kisiba, brought to light a number of patients who had never left their native district. Now *Glossina palpalis* does not occur in Kisiba. Prolonged search by expert collectors has failed to discover a single specimen, though in the western part of Kisiba, at the town of Kifumbiro, a few specimens of *G. morsitans* have been caught.

Among Dr. Kudicke's patients were fourteen women who had never visited a sleeping sickness area. In all of these trypanosomes were found. Eight of them had been married to men who subsequently died with all the symptoms of sleeping sickness. The husbands of four of the remainder were treated for sleeping sickness by the German expedition at Sese, and subsequently came to the author for further treatment, when trypanosomata were found. Of the remaining two women, one would give no particulars of her life, and the other admitted that a man from another district and who suffered from sleeping sickness, had lived for a month in the same hut as herself and her husband; the latter appeared healthy. On the other hand, Dr. Kudicke has never observed a case of trypanosomiasis in children who have never left Kisiba, nor has he been able to discover a case of sleeping sickness among the offspring of infected parents.

In the author's opinion the above facts show that sexual intercourse plays an important part in the transmission of sleeping sickness. He further observed that one man with trypanosomiasis had three wives, and all the latter suffered from the disease. In the case of another patient who left three widows on his demise, two of the women were subsequently proved by Dr. Kudicke to have trypanosomes in their blood. Confirmatory facts are, that all the women admitted having sexual intercourse with their husbands after the latter became ill; and further, the widespread idea among the natives that sleeping sickness can be communicated from man to woman. A. I. F.

Proposed Standard Preparation of Mercurial Cream.—In the *Journal de Pharmacie et de Chimie* for December 16th, 1907, M. Dumesnil makes a plea for a standard formula for mercurial cream.

A Committee appointed by the Société de Pharmacie of Paris has adopted the following recipe suggested by M. Dumesnil. Sixty grammes of pure liquid paraffin and 28 grammes of anhydrous wool-fat are sterilised separately in glass flasks for twenty minutes at 120° C.; 40 grammes of metallic mercury are then placed in a mortar (this and a pestle having previously been sterilised by burning alcohol). The wool-fat is next added. The metallic particles are triturated till, when examined with a magnification of 480 diameters, they look no larger than the fine granules of sodium urate found in urinary sediments under a similar power. Then the liquid paraffin is added, a little at a time. The product should weigh 126 grammes, and bulk 100 cc. The bottles to contain the cream should be previously sterilised at 180° C. A. I. F.

History of Mercurial Cream.—In the *Chemist and Druggist* for January 4th, 1908, there is a letter giving some interesting facts on the above subject.

It appears that in 1888 Lang, of Vienna, recommended a cream of the following composition :—

Mercury, ʒi.
Pure Lanolin, ʒi.
Olive Oil, ʒii.

Again, in 1890, Dr. Julius Althaus published a paper entitled "Treatment of Syphilis of the Nervous System." In this paper he described a mercurial cream as follows: "One part of metallic mercury thoroughly rubbed up with four parts of purest lanolin, and then well mixed with five parts of carbolised oil of 2 per cent. strength." A. I. F.

Correspondence.

THE ANNUAL DINNER—A SUGGESTION.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I beg to make the following suggestion, which, I think, if found practicable, would add to the popularity of our already popular annual dinner. The keynote of this popularity is, I take it, the association of old friends and places.

I have no doubt that it has occurred to most of us, when at the dinner, to find ourselves not placed near those with whom we most desire to hold communication, the only other opportunity being a hurried scramble before and after dinner. My suggestion is a grouping of the tables, somewhat on the following lines :—

A Headquarter-Staff table.
A Punjab table.
A Bengal table.
A Madras and Bombay table.
A Mediterranean table.
A South African table.
A Colonial table.

Each of these tables might then be divided into sections, thus :—

Punjab table.—Rawalpindi end, Lahore end, with Umballa and Peshawar in the centre.

Mediterranean table.—Gibraltar end, Malta end, with Egypt and Crete; and so on.

Of course, it would be fully understood that no obligation existed for anyone to dine at any particular table, and that anyone was welcome at any table. Intending diners could generally notify beforehand at which table they wished to sit, and often arrange among themselves at which section. Possibly, also, the table decorations might be made symbolic of each to some extent.

I am, &c.,
W. L. CHESTER,
Colonel, R.A.M.C.

Peshawar,
January 1st, 1908.

A SATISFACTORY RESULT.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—It may be of interest to report that in the case of total extirpation of the penis and testes, carried out by me on February 19th, 1906, there has been as yet no recurrence. The man is doing his duty, and Lieutenant-Colonel H. W. Murray states that "he looks, and says he feels, very well. He is quite stout and seems to have gained much flesh."

The case was reported in the Journal, vol. viii., p. 187.

I am, &c.,
F. J. W. PORTER,
Major, R.A.M.C.

Colchester,
January 9th, 1908.

VOLUME X. APRIL, 1908. No. 4.

Journal

of the

Royal Army Medical Corps.

Original Communications.

THE PHYSIOLOGICAL PRINCIPLES OF PHYSICAL TRAINING.[1]

BY M. S. PEMBREY, M.A., M.D.

Lecturer in Physiology, Guy's Hospital; Civilian Member, Army Medical Advisory Board.

EACH year physical training becomes more and more important for the Navy, Army and civil population, for the migration from the land to the towns has deprived the youth of this country of many of the opportunities for healthy muscular exercise which their forefathers possessed. It is unfortunate that the subject has not attracted among medical men the attention which it deserves. There appear to be two reasons for this neglect: on the one hand, the physiology of muscular work has not formed a special part of the teaching of medical students; on the other hand, physical training or culture has been so frequently exploited for pecuniary gain by so-called "professors," who have claimed for their methods the cure of almost every kind of disease, that the taint of quackery has clung to it.

The practice of physical training is, even at the present time, ahead of the theory, but each year physiological investigations show the value of the methods introduced by athletes. Experience has been

[1] Paper read before the United Services Medical Society on February 13th, 1908, at the Royal Army Medical College, Millbank, S.W., Inspector-General Sir Herbert Ellis, K.C.B., K.H.P., Medical Director-General of the Navy, in the chair.

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Lecturer in Physiology, Guy's Hospital; Civilian Member, Army Medical Advisory Board.

Each year physical training becomes more and more important for the Navy, Army and civil population, for the migration from the land to the towns has deprived the youth of this country of many of the opportunities for healthy muscular exercise which their forefathers possessed. It is unfortunate that the subject has not attracted among medical men the attention which it deserves. There appear to be two reasons for this neglect: on the one hand, the physiology of muscular work has not formed a special part of the teaching of medical students; on the other hand, physical training or culture has been so frequently exploited for pecuniary gain by so-called "professors," who have claimed for their methods the cure of almost every kind of disease, that the taint of quackery has clung to it.

The practice of physical training is even at the present time ahead of the theory, but each year [illegible] the value of the methods introdu[illegible]

[1] Paper read be[illegible] [illegible]908, at the Roy[illegible] [illegible]erbert Ellis, [illegible]

the guide of athletes, and experience is, strictly speaking, the result of numerous physiological experiments. Long ago, athletes recognised the necessity of progressive training in muscular exercise; the value of exposure to the open air in "hardening" the body; the necessity of clothing adapted to facilitate the loss of heat during exercise, and to retard it after work; the need of regular hours for meals, exercise, and sleep; and the avoidance of excesses of all kinds, especially drinking and smoking. They did not perform so-called "breathing exercises," but improved their "wind" in the natural manner by progressive running. Their method has been the English one of learning to do a thing by doing it, not the foreign method of first developing a system based upon theory and then applying it in practice. The development of training for games and sport has proceeded upon experimental lines, and the individual capacity and peculiarities of each athlete have received wide recognition; this is shown by the great difference in the style and methods of the best men. On the other hand, the authors and teachers of physical training in the gymnasium have insisted too much upon the importance of conventional postures and unusual movements, and have frequently sacrificed the benefits of exercise to their ideal of the human figure. They have unduly developed the use of apparatus and indoor work. It is necessary to remember that the physiological principles which underlie physical training have been and will always remain the same, whereas conventions and fashions change from year to year, and in the case of the Services can be altered by a stroke of the pen.

The true object of physical training should be an increase in the recruit's strength, agility, and capacity for muscular work. The power of endurance is far more important than a conventional military figure or the acquirement of acrobatic tricks. The build of a youth's body depends chiefly upon the characteristics of his ancestors, and has been determined, in great part, even before his birth; his individual peculiarities have been confirmed by a growth of seventeen years or more before he enlists. He is no longer so plastic as the boy, and will be injured rather than improved by too rapid and vigorous attempts to alter the shape and carriage of his body.

The principle of progression from easy exercises of short duration to more difficult exercises of longer duration is essential. Most recruits have been out of employment before they enlist, and in many cases they have not received sufficient food and healthy exercise for the proper development of their bodies. During their first

month of service they require plenty of food and light exercise. Unusual movements in gymnastic postures are not the most suitable, for they produce an amount of fatigue and an expenditure of nervous and muscular energy which are disproportionate to the work done. The co-ordinated and economical working of the muscles in any form of exercise can only be learnt by frequent practice; in walking, the recruit has had such practice, but before he enters the gymnasium he has probably not once assumed the postures involved in some of the exercises. Marching without a load is, for these reasons, a suitable exercise for the young recruit.

Many of the exercises found in systems of physical training are based upon the idea that all the muscles must be uniformly developed, and with this end in view postures which are never used in ordinary life are constantly assumed. The uniform development of all the muscles of the body is unnecessary and uneconomical. Muscles hypertrophied by unusual or acrobatic exercises will become smaller unless the exercise is repeated frequently. The maintenance of all the muscles in a highly developed condition, necessitates daily exercise of each muscle and the expenditure of much energy. The normal condition is division of labour and differentiation. Marching and digging are exercises in which infantry soldiers require progressive training. It is essential that a soldier should be able to march carrying a load and to dig entrenchments without undue fatigue; both of these forms of work can produce over-strain of the heart if the man has not been trained by progressive and frequent practice. Digging has not received the attention which it deserves, and it has even been decried as an exercise on the ground that it makes the men round-shouldered. Here again there is a danger that efficiency may be sacrificed to the ideal of a military figure. The strength and endurance of the English navvy are proverbial, and he does not possess the square shoulders desired by the drill-instructor.

It has been stated in official manuals that the "strictly military position assists greatly in the free and full action of the heart and lungs, and the consequent development of the whole body." If this position has such a beneficial effect, it is surprising that it has been specially reserved for the private soldier, and has never been adopted by sailors or athletes. The constrained military attitude with distended and rigid chest, hinders the action of the heart by restricting the free movement of the chest, whereby the passage of the blood from one side of the heart to the other is aided. It is, moreover, wasteful of nervous and muscular energy. The position

of "attention" is an abnormal one which can be defended only as a discipline.

The extent to which military ideals have attempted to override physiological laws is well shown by the instruction in "Infantry Drill," 1889, Part I., Section 10, p. 26, where it is laid down, as regards the position of the soldier in marching, that "His arms and hands must be kept steady by his sides; care being taken that the hand does not partake of the movement of the leg." It is now recognised that in marching the natural movement of the arms and the swing of the body should not be suppressed. A soldier ought to march in the most economical manner, in order that he may husband his strength and be capable of a great effort whenever the demand may be made. The soldier who marches in a rigid ceremonial manner may give the impression of dignified strength, but he is expending more nervous and muscular energy in maintaining his upright position than is necessary; while in restraining the natural movements of his arms he is wasting energy which would otherwise enable him to endure a longer march. Other things being equal, the soldier who can perform the longer march, or the same march with less fatigue, is the better man.

So-called "breathing exercises" have been introduced of late years into the physical training of the Navy and Army; they form part of the Swedish system, and this appears to be the chief argument advanced by the defenders of the exercises. Such exercises are based upon an erroneous interpretation of the physiology of respiration. The rate and depth of breathing are determined by the condition of the blood, and are adjusted to such a nicety that no artificial method can ever be an improvement. The recruits have been "passed" as healthy by the medical officer, and healthy men do not require to be taught how to breathe. It must be remembered that breathing is a process unconsciously performed by the child directly it is born, and is carried on perfectly by the adult even during the deepest sleep. The rate and depth of breathing vary with each individual, and the healthy recruit has had at least seventeen years' practice. Nasal breathing is normal during rest and slight exercise, but it is wrong to insist, as some teachers have done, upon such a form of breathing during hard work: mouth breathing under such conditions is natural, for it offers less resistance to the passage of air in and out of the lungs, and also assists in cooling the body. It is indeed unwise to direct the attention of recruits to their breathing, for the result is often to make them breathe unnaturally, or hold in their breath.

They should be ordered to keep their mouths shut when they are at rest or performing slight exercise, and told to breathe as they like when they are doing hard work.

The so-called "breathing exercises" are absurd, and in practice may produce emphysema, and certainly do increase the risk of infection from "colds," tonsillitis, consumption and other diseases. The men are taught to breathe out through the mouth with a loud blowing noise; the result is the discharge of a shower of small particles of saliva from each member of the squad. In "deep breathing" exercises the men, so far from deriving any benefit, often suffer from venous engorgement. The natural method of improving the "wind" is progressive running; the best proof of this is the fact that it has been successfully used for years by the trainers of athletes, racehorses, and greyhounds. A good "wind" is something more than a big chest; it is the capacity of the heart and lungs to accommodate themselves to the demands made upon them by muscular work. "Training," in short, is the training of the heart, and if the heart of a healthy man becomes weaker or disordered in its action, it is probable that the training has been bad. It is a fundamental fact that the blood must be driven through the lungs by the heart in order to be oxygenated by respiration. Muscular work not only quickens the heart-beat, but also produces deeper and more rapid breathing, owing to the great increase in the production of carbon dioxide and in the absorption of oxygen. A further objection to breathing exercises is the fact that the authors of systems cannot agree in their teaching; some maintain that thoracic breathing should be taught, others insist upon abdominal breathing. This disagreement is but natural, for the truth is that thoracic and abdominal breathing not only vary in different individuals, but even in the same individual, according to the conditions involved during rest and work.

The idea that artificial expansion of the chest gives freedom of action to the organs within, is erroneous and pernicious. The walls of the thorax are moulded upon the viscera which they contain. As long ago as 1876, Surgeon F. A. Davy, A.M.D., pointed out the dangers of exercises and drills designed to produce a distended and rigid chest. All exercises which produce prolonged fixation of the chest during muscular work are unsuitable for recruits. It is to the credit of the Navy that such a conventional figure of the chest has always been condemned, and common sense has asserted itself, not only in the free carriage and gait of the

sailor, but also in his clothing. It is necessary, however, to point out that the new system of physical training lately introduced into the Navy is not sound upon the question of chest-expansion and breathing. "Opening out the chest" is aimed at in order to afford the heart and lungs "ample space for their proper working." Overstretching of the lungs and emphysema may result, unless the diaphragm be abnormally pushed up by the abdominal walls and viscera. Fortunately, when the "opened out chest" is obtained, it is often in appearance only, and is due to the greater development of the pectoral muscles and the throwing back of the shoulders. Even if increased pulmonary capacity be obtained by such exercises, it does not necessarily follow that the "wind" is improved. A large so-called "vital capacity" is no evidence of a man's power of endurance or resistance to disease. It has already been stated that a good "wind" depends upon the co-ordinated working of the heart and lungs; a sound heart is essential.

"Heaving" exercises are also employed to produce expansion of the chest, and thoracic breathing is considered to expand the apices of the lungs better than abdominal breathing. The pectoral muscles are developed with the idea of strengthening the respiratory muscles, and it is thought that by the development of these muscles thoracic respiration is facilitated. The balance of evidence appears to be against these views. Men who constantly use their arms develop a more rigid upper thorax, in order that they may have a fixed point from which to work, and they increase their pulmonary ventilation by more active contraction of the diaphragm. Women with little muscular development show marked respiratory movements in the upper part of the thorax; this is due, no doubt, partly to the restriction of the abdomen by corsets, but in part only, for directly they perform much hard work with their arms, abdominal breathing is increased and thoracic diminished. Muscular exercise or work abolishes tight lacing in women, and the converse is equally true. Such a change from the thoracic to the abdominal type of breathing is an advantage if hard work is done with the arms.

It is well known that patients who are forced by difficult breathing to use their pectoral and other accessory muscles of respiration, fix the shoulder-girdle by grasping some rigid object with their hands. The sailor or soldier at work has no such fixed point; his safeguard is not the use of the accessory muscles, but a natural increase of ventilation by deep abdominal breathing, which

enlarges the diameter of the chest from above downwards, from side to side, and from before backwards. This was well seen even in the young boys in the Naval Gymnasium when they were breathing naturally and deeply after a march at the double; here were boys with freely mobile chests breathing deeply in the lower portions of their chests, and rightly so, because such a method is efficient.

The attempt to develop breathing power by separate exercises of the pectoral muscles, the intercostals and the diaphragm, is due to the mistake of taking anatomy as a guide in questions of physiology.

Training involves also the accommodation of the recruit to an outdoor life. Work in the open air "hardens" a man, diminishes his liability to "colds," consumption and other infectious diseases, and improves his appetite and nutrition. Work in the open air is for everyone the healthiest form, and, even if it were not, the soldier can only learn to bear the hardships of service in the field by practice during peace. There is too great a tendency to perform physical training inside the gymnasium.

The benefits of muscular exercise involve every part of the body, especially the nervous system. Work which gives pleasure is better than work which is irksome. Games in this respect have a great advantage over physical drill. This truth is generally recognised among civilians in this country, and even in France and Germany it can be seen that English games and sports are, with the support of many medical men, slowly displacing gymnastic exercises. A game produces less strain and distress than many gymnastic exercises, even although it involves far more muscular work. This is due to the absence of constrained and unnatural postures, to the freedom given to the personal equation of each man, and to the absence of the demoralising effect of uniformity. Uninteresting drills may be good discipline, but are undoubtedly bad muscular exercises. An exercise must be enjoyed, if the best effect is to be produced. Games, moreover, teach a man to act upon his own initiative in cases of emergency, and in many cases give excellent training to the eye. It must be granted that, in the training of large numbers of recruits, there is a danger of the weaker men not taking their proper share in the games, but it is possible to give special prominence to such exercises as obstacle races, which involve running, jumping, climbing and vaulting. In wrestling, swimming, bayonet fighting and fencing, the value of games could be obtained without detriment to discipline.

Exercises with the horizontal bar, parallel bars, pair of rings,

Indian clubs and dumb-bells should be discouraged; many of them are tricks which are not worth the time necessary for their acquirement, and the use of dumb-bells has produced the debased ideal of the "strong man" of the music-halls. The soldier should look upon the acrobat with contempt. The soldier's duty is to march well and to shoot straight.

Some of the span-bending, abdominal, and dorsal exercises of the Swedish system are not free from danger; they produce in many cases restricted breathing, venous engorgement and strain; they are based upon anatomical, not physiological reasoning. In some cases the stretching of muscles, and even of large blood-vessels, is their aim; they lack all the benefits which can be obtained by natural movements. Such exercises are more likely to damage men than boys, for the latter are in a more plastic stage and can bear with impunity contortions which will injure an adult.

The way in which the Swedish system constantly parades the educational and medical aspects of its exercises is one of its worst features. Recruits are not invalids, and it is small consolation to be told that the uncomfortable, unnatural and undignified postures involved in span-bending, true dorsal and abdominal exercises, are thought to be good because they develop certain muscles. The very fact that they are exercises which cause more or less discomfort in most recruits, and actual distress in some, is from a physiological point of view strong evidence against them. In the training for games and sport, on the other hand, no attention is paid to a few anatomical details; experience, which is simply the result of numerous experiments, is the safest guide. A knowledge of anatomy never made a good trainer or athlete. The misuse of a little anatomical knowledge has given to the Swedish system the appearance of a scientific basis which it does not possess. Fortunately there appears to be no great danger that the value of games and sport will ever be under-estimated in the Navy and Army, although in the country generally an attempt is being made to belittle games, and to impose a gymnastic course upon children and adults alike. It is noteworthy that the authors of many of these gymnastic systems are foreigners, who do not recognise or sufficiently respect the value of the English games and sports.

The official tests of proficiency should be those which bring out a recruit's capacity to co-ordinate his muscles, to accommodate himself to the demands of muscular work, and to bear fatiguing exercises without undue distress. The performance of difficult tricks upon the horizontal bar is no proof that a man is well

trained for a soldier's life. Naval and military competitions and displays should consist of exercises of naval or military value: obstacle races, which involve climbing, vaulting, jumping and running, are far more valuable, from the point of view of sailor, soldier and physiologist alike, than acrobatic performances. The Navy and Army in this respect can educate the public, and protect the traditional ideals of exercise in games and sport which have done so much to make this country great.

DISCUSSION.[1]

Commander WATSON, R.N., said that before coming there that night he had had the advantage of having the headings of the lecture placed in his hands, which had enabled him to prepare a few notes on physical training in the Navy. As regards the detailed headings, he proposed to deal with them as rapidly as possible.

He explained that his experience of physical training work began in 1895, in which year he was called to take charge of the Cadets at Dartmouth. At that time he knew nothing of the subject beyond the ordinary exercises on the horizontal and parallel bars. He found at Dartmouth a tiny building called a Gymnasium, with insufficient accommodation for the number of boys to be trained; also, there were no rooms for changing. The time allowed at that time for gymnastics amounted to about half an hour a week, and as a matter of fact in some cases to half an hour a fortnight. The exercises included the use of the horizontal and parallel bars, occasionally combined with weight-lifting, from which the boys may have derived some benefit. Weight-lifting machines of all sorts were obtained, and used with, he now believed, distinct physical detriment. He supervised all the work, but the instructors had not the slightest idea of the purpose of gymnastics beyond the development of muscular strength. The period he referred to was from 1895 to 1898.

To-day, Dartmouth has a fine gymnasium, beautifully decorated and with good changing rooms outside. The boys are taught to *train* and not to *strain* their muscles, the classes consist of from twenty to thirty boys, and these classes are constantly supervised by the officer in charge. Commander Watson considered that nobody can perform exercises thoroughly unless they have plenty of practice. The system of training now employed was the Swedish.

He entirely concurred with Dr. Pembrey that the true object of physical training should be to increase the recruits' working capacity. The entire basis of training adopted in the Navy was the principle of progression from easy exercises of short duration to more difficult exercises of longer duration. He did not agree with Dr. Pembrey that the uniform development of all the muscles of the body is unnecessary

[1] Reported by Lieutenant A. Irvine Fortescue, R.A.M.C.

and uneconomical. He maintained that if a man does not get physical training on board ship, all he did was to get liver complaints, and fight his next neighbour. Therefore physical training ought to continue. He considered that there was no harm in the position of attention, as it was one of alertness and not of strain.

He agreed with Dr. Pembrey that exercises with the horizontal and parallel bars, pair of rings, Indian clubs and dumb-bells should be discouraged. He considered that the question as to what exercises were really of military value was a matter for the naval and military authorities to decide for themselves.

As regards breathing exercises, fixation of the chest during muscular work, span-bending and dorsal movements; these were physiological questions on which he was not prepared to express an opinion. We had not yet had sufficient practical experience of the present system of physical training to be in a position to pronounce either for or against it.

Colonel S. P. Rolt, Inspector of Gymnasia, reminded his hearers that the history of physical training in the British Army went back as far as 1869. Colonel Fox, Colonel Napier, Colonel Onslow and others were the pioneers of the subject. In those days it was exceedingly difficult to obtain adequate instruction, and Colonel Fox went himself to Sweden to investigate the system in vogue in that country. On his return he introduced a certain amount of what was then called "Free Gymnastics" into the training of the British soldier. It was not till 1905, however, that the complete Swedish system of physical training was adopted in the Navy. Six months later a system of physical training was drawn up by Major Moore and himself, with much valuable assistance from Commander Watson, R.N., and was subsequently considered by a committee including Dr. Pembrey and Dr. Haldane. This system was that at present in use at Aldershot. As regards what Dr. Pembrey called the "strict military position," Colonel Rolt considered that it was not one of strain but of alertness. In certain cases, perhaps, the chest was unduly advanced, and the stomach too forcibly retracted; but in the Guards, at any rate, this was due to the men being taught to come from the order to the slope in a single movement, when, unless the stomach was well drawn in, the rifle would not clear the pouches on the belt.

Colonel Rolt pointed out that nowadays the arms are not kept stiff when marching, but are allowed to swing freely. As regards breathing exercises, he considered that their chief object was to restore the circulation and breath to normal, after severe exercise. He was doubtful, however, whether the same result was not attained just as quickly by simply sitting down and resting. He contended that some special system of training was necessary for recruits in order to correct the faults of carriage and gait acquired during eighteen or nineteen years of faulty training and defective hygiene.

As regards the question of obstacle races, games, fencing, &c., so strongly advocated by Dr. Pembrey, Colonel Rolt denied that under the present system these were neglected. At present, training was divided into (1) educational gymnastics, represented by physical training, which were compulsory, and at certain fixed hours; and (2) recreational gymnastics, represented by boxing, fencing, wrestling and the use of apparatus, which could be indulged in in the men's own time and according to their inclination. So-called acrobatic tricks at military displays and competitions interested the soldier very greatly, and any changes in these would require very careful consideration. In conclusion, Colonel Rolt asserted that two or more years must elapse before the results of the present Swedish system of physical training in the Army could be apparent or available for adequate criticism.

Dr. J. S. HALDANE, F.R.S., Reader in Physiology at the University of Oxford, strongly condemned so-called "breathing exercises" as utterly useless and absurd, because normal breathing is regulated automatically, so as to keep the alveolar air with a constant percentage of 5·6 carbon dioxide. It was quite impossible to establish a constant habit of breathing more deeply than usual. With regard to the dissemination of particles of saliva through the atmosphere in the course of breathing exercises, Dr. Haldane mentioned the case of a child who, after going through a course of such movements at school, described them in perfect good faith as "spitting exercises." He laid stress on an experiment recently made in the House of Commons: An orator, having previously washed out his mouth with an infusion of *Micrococcus prodigiosus*, declaimed a selection from "Julius Cæsar" from the front bench; as a result a large number of sterile gelatine plates, placed in all parts of the House, gave a growth of the micrococcus. Dr. Haldane therefore strongly condemned the practice of making classes go through breathing exercises in a closed and often insufficiently ventilated space.

Dr. PEMBREY, in summing up, spoke strongly as to the necessity of medical officers having more control over the Navy and Army systems of physical culture. At present, medical officers have to bear the charge of passing recruits who are unfit, if these recruits have to be invalided, often as the result of a pernicious method of so-called training, after a few months service. He again laid stress on the futility of breathing exercises, and pointed out that a child is not taught to breathe, but does so automatically. We breathe naturally just as deeply or slightly as we require. With regard to Commander Watson's argument that personal experience was alone of value in dealing with physical training, the fact of a man's being a great athlete or gymnast was no proof of his having any acquaintance with the great physiological principles which underlie all forms of physical culture. "Why go to a foreign nation for a system of training? Why slavishly follow the Swedes, because, forsooth, they have been using a certain system for a paltry hundred years?

What have the Swedes done during that period? What benefits have accrued to them as a nation from their methods of physical culture? For a thousand years or thereabouts the British have been efficient, and have accomplished infinitely more than the Swedes, who obstinately cling to breathing and other bad exercises because these are a part of a system which has become a national fetish. All the Continental nations follow us in matters of sport, which very word they have adopted into their languages." Dr. Pembrey concluded by saying that in his opinion there should be no drill in schools, as good games were amply sufficient for purposes of physical training. He had heard that cardiac disorder was on the increase in the Navy, but could not say that it was coincident with the introduction of the Swedish system. The men ought, he thought, to be systematically and gradually trained in the muscular work involved in coaling against time, and in stoking. He much regretted that the combatant officers who had spoken had dismissed the subject of breathing exercises as purely physiological, and therefore beyond their scope.

A vast improvement in physical training had been effected by Colonel Rolt and Major Moore, and he wished to state plainly that he did not believe that physical training had been the sole cause of disordered action of the heart. Unsuitable clothing and the lack of progressive training in marching with a load were, he was convinced, important factors in the causation of that condition. He believed that some system of physical training was absolutely necessary for recruits and that nothing but good would result from free and open criticism.

The CHAIRMAN (Inspector-General Sir Herbert Ellis, K.C.B., K.H.P., Director-General of the Royal Navy) proposed a vote of thanks to Dr. Pembrey for his most interesting paper, which was carried by acclamation.

X-BODIES FOUND IN THE BLOOD OF HUMAN BEINGS AND ANIMALS.

By Majors W. H. HORROCKS and H. A. L. HOWELL.
Royal Army Medical Corps.

We wish to place on record some peculiar and, as we believe, hitherto undescribed bodies, found in the blood of patients who had recently suffered from fever of a varying type, and also in the blood of oxen.

Case of P.—The bodies first came under our notice when examining blood-films taken from a man (P.) who had recently suffered from a typical attack of tertian ague, acquired at his farm in Spain. Three smears were made on February 4th, 1907, and one of them was found, when stained by Leishman's method, to contain the X-bodies in every field.

The bodies, when stained, were characterised by a faint capsule with a circular centre staining deep blue; they varied in size, some being as large as a red corpuscle, others only about one-eighth the size of a red corpuscle. In addition to these forms, which were the most common, the following were also seen: (*a*) A small blue circular centre surrounded by four or more faint capsules, concentrically arranged; (*b*) two circular bodies, each having a dark blue central point surrounded by a light blue ring, enveloped in one capsule which appeared indented as if two capsules were in process of formation; (*c*) similar to (*b*), but the part surrounding the deep blue centre stained a deeper blue, and two indented capsules were seen; (*d*) a dark blue central part shaped like a crescent, containing a small circular body, with a deep blue central point within the arms of the crescent.

None of the bodies on the slide showed any signs of chromatin. The characters of the X-bodies are well shown in drawing (A).

At first we thought that the bodies might be the cause of the fever, but the attacks having been typical of tertian ague, careful search was made through films taken a few days later, and at length tertian malarial parasites were detected.

On February 7th three blood smears were again made and a drop of blood was examined on a warm stage. A few bodies were found in the stained films and circular bodies were seen in the blood on the warm stage, but though the preparation was watched for hours no amœboid movements were noticed.

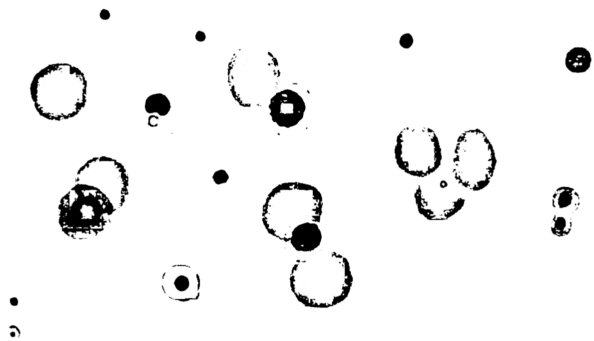
On February 9th blood films were again made, but no bodies were detected in them. One cubic centimetre of blood was also removed when the films were made, and added to 4 cc. of 1 per cent. sodium citrate; the mixture of blood and citrate was incubated at 22° C. Smears were made from the citrated blood daily and stained by Leishman's method. Nothing was seen until February 12th, when numerous bodies were found in a preparation made from the bottom of the tube. The characters of the bodies are shown in drawing (B). None of the small forms found in the original blood were seen; the bodies were larger than a red corpuscle, and both the centre and the capsules stained well; several bodies were noticed to be apparently dividing by a process of fission carried through the centre. Preparations taken from the surface of the citrate blood showed no bodies; only blood corpuscles were found.

On February 13th and 14th the citrated blood still contained similar bodies in the depth of the fluid, but examinations made at later dates gave negative results.

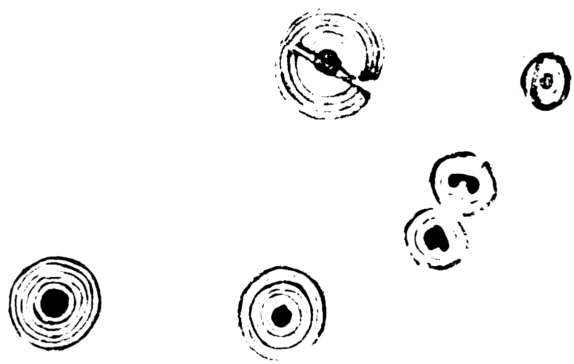
Attempts were made to cultivate the citrated blood containing X-bodies on ordinary solid nutrient media, by removing with a pipette a portion from the bottom of the tube and distributing it over the surface and in the water of condensation. The media were incubated at 22° C. and 37° C.; no growth occurred; a few bodies, staining badly, were, however, found at the end of twenty-four hours in the water of condensation of the tubes kept at 22° C. No bodies were ever found in the tubes incubated at 37° C., and later examinations of the media incubated at 22° C. gave negative results.

On February 13th half a cubic centimetre of the citrated blood, which at that time contained numerous bodies, was injected intravenously into a rabbit. Three days later, smears made with blood taken from this rabbit's ear having given negative results, one cubic centimetre of blood was removed from the posterior vein of one of the ears, which had been carefully sterilised, and added to sodium citrate solution; the mixture was then incubated at 22° C. Nothing was found in the citrated blood for a week, when numerous bodies were found in stained preparations made with fluid taken from the bottom of the tube. The citrated blood was kept at 22° C. for a month and examined at frequent intervals, but no bodies were again found; the preparations only showed degenerated blood corpuscles.

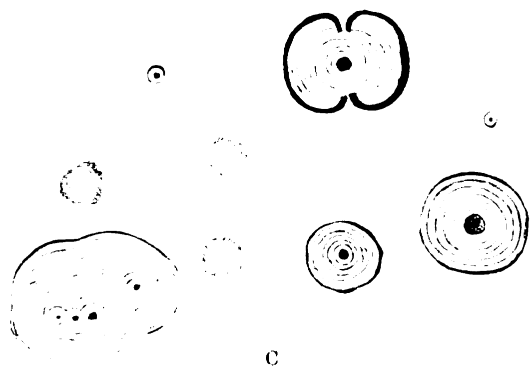
On February 19th, 22nd, 25th and 27th, and on March 2nd and 6th, blood was removed from the rabbit's ear and added to



A



B



C

To illustrate paper by Majors W. H. Horrocks and H. A. L. Howell on X-Bodies found in the Blood of Human Beings and Animals.

A—Blood film, P. B—Citrated blood, P. C—Citrated blood, rabbit.

sodium citrate solution. After incubation at 22° C. and 37° C. for periods varying from three to five days, X-bodies were found in smears made with fluid taken from the bottom of the tubes. Blood taken from the ear at later dates and treated in the same manner gave negative results.

The characters of the bodies found in the rabbit's citrated blood are shown in drawing (C). It will be seen that very small forms appeared as well as the large forms found in P.'s citrated blood, suggesting that a reproduction of the X-bodies had taken place in the body of the rabbit.

Case of G.—This man was a laboratory assistant, and suffered from fever of an irregular type during December, 1906, and January, 1907. Blood smears, stained by Leishman's method, were carefully examined during the febrile period and convalescence, but nothing abnormal was found. His blood serum was also tested for agglutination with the *Micrococcus melitensis* and *Bacillus typhosus*, but no reaction occurred with either organism.

On January 11th one cubic centimetre of blood was removed and added to sodium citrate solution, the mixture being then incubated at 22° C. Three days later numerous typical X-bodies were found. Small bodies with a single capsule were most numerous; some large forms with several concentric rings were, however, also present. Examinations of the citrated blood at later dates gave negative results.

Case of Captain G.—This patient was an officer in the Royal Garrison Artillery. He was ill from February 14th to 23rd, 1907, suffering from ill-defined fever for two days, followed by painful enlargement of the spleen. On February 20th blood films were prepared and stained; numerous X-bodies were found, which stained deeply and corresponded very closely to those depicted in drawing (B). Next day films were again made but no bodies were found; one cubic centimetre of blood was then added to sodium citrate solution, and the mixture incubated at 22° C. After seventy-two hours' incubation, a few bodies were found in smears made with fluid taken from the bottom of the tube; similar bodies were also found in the fluid three days later, but subsequent examinations of the citrated blood gave negative results.

On February 23rd films made with the patient's blood were again found to contain large numbers of X-bodies. One cubic centimetre of blood added to sodium citrate tubes and incubated at 22° C. and 37° C., once more showed the bodies after three and four days' incubation respectively. Smears made with the citrated blood at later dates showed no bodies.

On March 2nd a few granular degenerating X-bodies were found in films made with the patient's blood, but citrated blood tubes prepared on the same day and incubated at 22° C. and 37° C. never showed any signs of them.

Case of M.—This man was a Spaniard who had been admitted into the Colonial Hospital suffering from fever and enlargement of the spleen. The case was supposed to be malarial in nature, and films made with the patient's blood were sent to the laboratory for examination. One slide was found to contain numerous small X-bodies having a single capsule, but no malarial parasites could be detected. Subsequent examinations of the patient's blood gave negative results, and he rapidly convalesced under treatment with quinine.

Case from Tangier.—This patient resided in Tangier, and at one time was thought to be suffering from enteric fever. Serum diagnosis, however, having given negative results, blood-films were prepared and forwarded to Gibraltar for examination. When stained by Leishman's method, one of the slides was found to contain a large number of X-bodies, both small and large forms being present.

Animals.—An outbreak of foot and mouth disease having occurred amongst the Galician cattle kept by the contractor at the North Front for the use of the naval and military garrison, films were made with blood taken from the ears of the affected animals in the hope of finding the *Cytorrhyctes aphtharum* described by Siegel. No protozoa were seen, but one slide was found to contain numerous X-bodies. The same bodies were also found in citrated blood taken from another animal, after the usual incubation at 22° C.

On May 23rd, 1907, an animal from Tangier, slaughtered in the civil slaughter-house at the North Front, was found to be suffering from a disease known in Spain as "Bacera," which is characterised by fever, accompanied by marked congestion of the lungs, liver, kidneys and spleen. Portions of the affected organs were cultivated in the usual bacteriological media, but no growth occurred. Smear preparations were, however, made with the broth in which a portion of the liver had been planted out, and, on staining with Leishman's dye, one of them was found to contain numerous X-bodies.

Having in view the diverse nature of the cases in which the X-bodies were found, we are not justified in considering that they were the cause of the pathological conditions observed. The only

symptom common to both the human beings and the oxen was fever, and it is possible that the bodies were the result of the febrile state induced by some other agent. It should, however, be noted that we have examined a very large number of blood-films taken from patients suffering from indefinite febrile attacks during 1907, without finding the X-bodies.

We regret that owing to failure of material we have not been able to submit the bodies to complete differential staining processes so as to ascertain their exact nature.

Having read Lorrain Smith's paper on the staining of fat, it occurred to us that possibly the X-bodies might be acid fats; we accordingly stained by his methods a series of blood-films taken from patients suffering from fever, and also a series of neutral and acid fats, but failed to obtain any signs of the X-bodies in any of the preparations.

DISINFECTION BY FORMALDEHYDE.

By Lieutenant-Colonel R. H. FIRTH.

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Probably the most generally popular disinfectant at the present time is formic aldehyde, or the aldehyde of methyl. It is especially popular as a gaseous disinfectant, being superior to chlorine, sulphur dioxide and nitrogen tetroxide as a germicidal agent; moreover, it is less dense, more diffusible, and more easy to work with than these other gases. Its aqueous solution is known commercially as formalin, and contains from 37 to 40 per cent. of the aldehyde. If concentration is carried beyond this point, a polymeric form of the aldehyde, paraformaldehyde, is precipitated as a white solid, which must be heated up to 156° C. before it can exercise any disinfectant action. The antiseptic and germicidal properties of formaldehyde vary according as to whether it is in aqueous solution or exists as a gas. In both forms it has been the subject of personal experimental work during the last three years, and the results may be summarised in the following review.

In Aqueous Solution.—Previous observers, when working with formalin, have obtained somewhat irregular results, owing probably to the varying strengths of the solution of the formic aldehyde. In the various experiments made by ourselves, the formalin employed has always contained 37·4 per cent. of formaldehyde,[1] and the observations were designed to test both the antiseptic and the germicidal properties of formalin of that strength. The tests made to determine the antiseptic action of formalin covered a wide range of microbial material, such as earth, hay, various moulds, *Bacillus coli communis*, *B. pyocyaneus*, *B. subtilis*, *B. prodigiosus*, *B. acidi lactici*, *Staphylococcus pyogenes albus* and *aureus*, *B. Typhosus*, *B. dysenteriæ*, *Vibrio choleræ*, and *B. enteritidis* (Gärtner).

When dealing with moulds, it was found that the greatest

[1] The difficulty experienced in determining accurately the strengths of solutions of formaldehyde is considerable; in our own case we are indebted to my friend, Mr. O. Williams, for some of the analyses. In all cases the method of Finkenbeiner has been employed, titrating with hydrogen peroxide and caustic soda solutions. An account of this method is to be found in Sutton's "Volumetric Analysis," and in the last revision of the "United States Pharmacopœia."

dilution of the formalin which would inhibit growth was 1 in 1,000, while various soils or earths, when seeded into broth and other cultural media, failed to give bacterial or other growths if the formalin were present to a greater extent than 1 part in 4,500, and in a similar way no bacterial growth occurred in infusions of hay, provided the formalin were present to the extent of 1 in 3,900.

Another series of observations was made, dealing with pure cultures of different bacteria. These in general terms showed that many micro-organisms were able to grow in dilutions of formalin as low as 1 in 4,200, a few were restrained in a dilution of 1 in 6,000, but none appeared able to grow in a solution stronger than 1 in 2,900. The following micro-organisms failed to grow in media wherein the formalin was present to the extent of 1 in 2,900: *S. pyogenes albus, B. typhosus, B. coli communis, B. pyocyaneus, B. subtilis, B. prodigiosus* and Gärtner's bacillus. The bacillus of dysentery and *S. pyogenes aureus* seemed incapable of growth in media containing 1 part of formalin in 4,200. The vibrio of cholera and the *B. acidi lactici* could not develop in the presence of 1 part of formalin in 6,000. In all these observations the temperature of incubation was 37° C. and the period one week.

The actual germicidal power of formalin in various strengths was the object of inquiry in respect not only of such materials as human fæces and sputum, but also in the case of pure cultures of various micro-organisms. This was a very laborious undertaking, as the earlier tests were made with too great dilutions. The final results obtained show that a 10 per cent. solution of formalin completely deodorises the most offensive fæces at once, while a few minutes' exposure is required in the case of 3 and 5 per cent. solutions. Fæces exposed to a 10 per cent. solution of formalin are quickly rendered sterile, all the non-spore-bearing forms being destroyed after a contact of ten minutes, but the spore-bearing organisms are not killed until the lapse of a forty-minute contact. With a 5 per cent. solution most of the non-spore-bearing organisms in fæces are destroyed in fifteen minutes, but a few survive half-an-hour, while the spore-bearing forms can resist practically an hour's contact with solutions of this strength. When a 3 per cent. solution was used, non-spore-bearing forms survived twenty minutes, and the spore-bearing organisms grew after a contact of two hours. In all these observations upon fæces, care was taken to add the diluted formalin in a volume such as to equal approximately the fæcal mass operated upon.

Thus, say the fæces equalled two fluid ounces in approximate volume, two ounces of the diluted formalin were added and the whole intimately mixed by stirring with a stick. After the first few tests, individual fæcal masses were not measured, the eye soon being able to form an approximately correct estimate of the mass or volume. Experience gained in the course of these investigations suggests that an ordinary small movement of the bowels may be taken to measure a bulk equal to four fluid ounces, while a free or large motion is quite eight fluid ounces.

The experiments upon sputum have been relatively few, as facilities have not been available to carry them out thoroughly. The few observations made indicate that at least 10 per cent. dilutions of formalin are needed to kill tubercle bacilli in sputum and even then the contact must extend over an hour. If 5 or 3 per cent. dilutions are employed, the period of contact must be quite three hours.

In dealing with the case of pure cultures of various micro-organisms, a series of tests shows that a 10 per cent. solution of formalin kills all the non-spore-bearing forms enumerated, in ten minutes, the two most resistant being *S. pyogenes aureus* and the *B. enteritidis* of Gärtner, which require a contact of quite that time. As it is somewhat extravagant to use a 10 per cent. solution indiscriminately, a number of trials were made with weaker solutions, such as 1, 2, 3, and 5 per cent. These showed that a 1 per cent. solution of formalin kills only the vibrio of cholera in ten minutes, the various other forms mentioned requiring contacts varying from one and a half to two hours. A 2 per cent. solution kills in ten minutes only *B. pyocyaneus*, the other forms needing an exposure of quite an hour for destruction. A 3 per cent. solution is efficient in destroying the more resistant forms in half an hour, and, curiously enough, the effects of a 5 per cent. dilution is to all intents and purposes the same.

The conclusion to be drawn from these observations is that, on account of its deodorant and germicidal properties, formalin in a 10 per cent. solution is one of the most useful agents at our disposal for the disinfection of infected human discharges, allowing in all cases an exposure of one hour after thorough mixing. If weaker solutions are employed, the period of contact must be fully two hours.

Closely associated with the use of formaldehyde in watery solution is the question of its application to wall and other surfaces in the form of a spray for securing disinfection. This is a well-

known method and probably acts in a double way, namely, by virtue of direct contact of a watery solution of formaldehyde with infected surfaces and volatilisation of active gaseous formaldehyde from the wetted areas by evaporation. We have tested this method, and find that a 2 per cent. solution of formaldehyde made by diluting 8 fluid ounces of formalin with water to 1 gallon suffices, if carefully sprayed by an Equifex or other sprayer, to adequately cover and disinfect 600 square feet of wall. To do this properly takes quite an hour and a quarter. If hurried, or if this volume of solution be made to cover a larger area, patches escape direct application of the reagent and consequent disinfection. Observation shows that, as ordinarily carried out, the so-called disinfection of a room or enclosed space by spraying is a farce. Unless the operators are watched and supervised throughout, the work is scamped and scientifically valueless. It is unpopular with the men detailed to do it, and great difficulty is experienced in getting it done properly. Moreover, to efficiently spray the walls, ceilings, and various fixtures in a room measuring 22 feet by 18 feet by 10 feet, and presenting roughly 800 square feet of wall surface, took two hours. In larger rooms the labour would be proportionate. The opinion formed is that, as ordinarily carried out, this mode of disinfection is open to many fallacies and quite unreliable. It would be as well, in the interests of scientific preventive medicine, to discourage its continuance.

As a Gas.—The value of formaldehyde as a gaseous disinfectant has been established by the work of many observers. The gas may be generated in various ways. The first experiments aimed at its generation by the evaporation of ordinary formalin in an open dish. By this method so much paraform, or inert solid formaldehyde, is produced that no reliable quantity of the active gas can be obtained. Following this, special lamps were devised for generating the gas from methyl alcohol. The earliest of these was the Formogène Richard. A lamp of this kind, holding five pints of methyl alcohol with three burners, generated formic aldehyde in sufficient quantity to disinfect the containing surfaces of a room of 2,500 cubic feet. This type of generator is now obsolete, as the cost of methyl alcohol of the proper quality militates against its general use. Trillat, one of the first workers with formaldehyde vapour, volatilised formalin mixed with calcium chloride under a pressure of three atmospheres from an autoclave. This method has not found much favour, owing to the expense involved in working with an autoclave. Since then, other special

generators have been devised; the more important of these are the various types of Alformant lamp for converting solid paraformaldehyde into gas by the heat and moisture derived from the combustion of methylated spirit, this is Schering's method.

For the volatilisation of formalin the chief special generators are "Lingner's" lamp, the "Trenner-Lee" apparatus, and the "Torrent" vaporiser. All these have been the subject of experimental tests, as well as a new method of liberating formaldehyde gas from formalin by pouring the formalin quickly upon fine crystals of permanganate of potassium, contained in a suitable metallic vessel.

Each of these methods needs to be considered in detail, but before proceeding to do so reference must be made to the fact that few observers have made any attempt to determine the exact amount of formaldehyde gas that is present in the air of any space subjected to fumigation by some generating apparatus.

The more notable exceptions are von Brunn[1] and Base,[2] who made direct determinations on the charged air, while several others obtain their percentages indirectly. Space does not permit of this matter being discussed further, but those desirous of pursuing the subject should consult the literature noted below.[3]

The mere chemical determination of formaldehyde in air is not difficult, but the real difficulty is rather in obtaining suitable appliances and facilities for extracting the desired volume of air. Some determinations of this nature have been made by us, using a small room of 800 cubic feet capacity, and extracting the air by means of a glass tube passed through a keyhole, connected by rubber tubing with two wide-mouthed bottles, each capable of holding half a pint and fitted with alternating long and short connecting glass tubes. Each bottle was charged with 150 cc. of distilled water, through which the air of the chamber was drawn

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[1] von Brunn, "Formaldehyddesinfektion durch Verdampfung verdünnten Formalins." *Zeitsch. f. Hygiene*, 1819, Bd. 30, p. 201.

[2] Base, "Formaldehyde Disinfection." *Journ. Amer. Chem. Soc.*, 1906, No. 8, p. 964.

[3] Kingyoun, "Formaldehyde as a Disinfecting Agent," *Public Health Reports, U.S.A.*, January 29, 1897; also Sprague, "Rapid Disinfection with High Percentages of Formaldehyde," *Med. News*, December 11, 1897; also Hill and Richards, "Note on Formaldehyde," *Proc. 13th Ann. Meeting Amer. Pub. Health Association*, December, 1902; also Trillat, "Présence Normale de la Formaldehyde dans les Produits de la Combustion incomplète," *Rev. Hyg.*, February 20, 1905.

by means of a partial vacuum created by the syphoning off of water contained in a metal vessel of 30 litres capacity (rather more than 1 cubic foot), which was coupled up with the tube leading from the wash-bottles. A single discharge of the water in the tank entailed the sucking of a cubic foot of air through the water in the bottles. The water in the bottles acted as an absorbing medium, taking up all the formaldehyde present in the air passing out of the chambers, as sucked out by the aspirator. The time taken to draw 1 cubic foot of air was one hour; this slow withdrawal ensured adequate absorption of the formaldehyde by the water as the air bubbled through. The determination of the formaldehyde contained in the water of the wash-bottles was made by a colour-comparison method analogous to Nesslerising, using 5 cc. of Schiff's reagent to each 50 cc. of formaldehyde water. For comparison work, formalin of known strength was used as a standard solution of formaldehyde. The pink to purple colour which Schiff's reagent gives in the presence of formaldehyde is sufficiently characteristic and distinct to make the colour comparison easy and reliable. Schiff's reagent can be made in the following way: dissolve 1 gramme of fuchsin in a litre of distilled water, to this add 20 cc. of a solution of sodium bisulphite (sp. gr. 127), and after one hour add 10 cc. of pure hydrochloric acid. Unless kept in a well-stoppered bottle, this reagent is apt to deteriorate.

A number of experimental observations have been made with the Alformant lamp, employing the volatilisation of tablets of paraform to secure the disinfection of wall and other exposed surfaces in rooms of varying capacity. On volatilisation, one tablet liberates approximately 0·9 gramme of gaseous formaldehyde. The experience gained shows this method to be simple, so far as the generation of formaldehyde is concerned, but open to some fallacies. Using *B. typhosus*, *B. coli communis*, *B. prodigiosus*, and *S. pyogenes albus* as test micro-organisms exposed on various surfaces, it has been found that, when the room temperature is below 60° F. and humidity under 70 per cent., to ensure disinfection of walls and other exposed surfaces in carefully-closed rooms, at least thirty-five tablets of paraform must be used for each thousand cubic feet of space. If the humidity, as revealed by the wet and dry bulb-thermometer, be over 70 per cent., and the temperature be over 60° F., then thirty tablets suffice for each thousand cubic feet of space, or 100 square feet of wall surface. In a saturated atmosphere with a temperature not below 50° F., the volatilisation of twenty-

five tablets has been found sufficient for these spaces and areas. Another fact is also brought out, which is that no single lamp is capable of diffusing the generated formaldehyde over a greater superficies than 350 square feet of floor area; hence, in large rooms, one or more lamps must be employed in proportion to size. In all cases the room should be left closed for at least six hours after completion of volatilisation. If the method is tried to secure disinfection in a tent, the number of tablets per 1,000 cubic feet must be trebled, and the tent well pitched, well closed, and absolutely wet.

As regards the amount of formaldehyde present in the air of a room one hour after the commencement of this method of formaldehyde generation, two estimations have been made. In each case the room was 800 cubic feet capacity, and thirty tablets were volatilised, the percentage humidity being 70 and the temperature 58° F. The volatilisation of these tablets represented theoretically the charging of this room space with 27 grammes of formaldehyde gas, or 0·033 gramme per cubic foot of air. Two withdrawals of a cubic foot of air from the room yielded in one case 0·011 gramme formaldehyde, and in the other 0·013 gramme formaldehyde, or, roughly, one third of that which had been discharged into the space. The remaining two-thirds had partly escaped, possibly by leakages, and some had undoubtedly been absorbed by the paper on the walls and other fittings of the room. Experiments have indicated that uniform destruction of exposed micro-organisms by this method cannot be relied upon.

We may now pass to a consideration of the use of special generators, such as the "Torrent," the "Trenner-Lee" and the "Lingner" lamp. These are designed to generate active formaldehyde gas by the heating or boiling of formalin and aqueous solutions of the aldehyde. The efficiency of these methods depends much upon the question whether paraformaldehyde is formed when formalin is heated. The statement is freely made that formaldehyde solutions cannot be heated without polymerisation and thus interfering with further evaporation.

Novy and Waite[1] assert that "The fear of polymerisation of formalin on boiling is not well grounded"; on the other hand, von Brunn[2] states that when formalin of about 32 per cent. strength or more is distilled from a glass flask the residue on

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[1] Novy and Waite. "The Disinfection of Rooms," *Med. News*, 1896, p. 72 and p. 664.

[2] von Brunn, *op. cit.*

cooling becomes opaque, indicating paraformaldehyde; he goes on to say that only when diluted solutions, 20 per cent. or less, were distilled, is there any formation of paraformaldehyde.

We have investigated this point, and are of opinion that, if formalin be treated in an open vessel, polymerisation does take place towards the end of the concentration, but if diluted formalin be heated rapidly in some container, under slight pressure, the formation of inert paraformaldehyde is reduced to such small extent as to be practically negligible. The advantage of this method of generating formaldehyde from an aqueous solution, is that it secures a convenient emission of water vapour into the air space, the presence of which is essential for efficient disinfection of surfaces by any gaseous reagent.

The "Torrent" apparatus is constructed on this principle, and consists of a boiling vessel, which contains the solution to be gasified, and is closed by a cover which carries distributing nozzles. The boiling vessel rests in an outer case or mantle, below which is the source of the heat in the form of a spirit lamp. A safety-valve is inserted in the cover, and a vertical nozzle is also fitted as a precaution in case the pressure should get too high. Either formalin or solutions of the solidified paraform may be used. A number of experimental tests have been made with this apparatus, which show that it is capable of destroying germs exposed on walls, ceilings, and other surfaces. The method of working is comparatively simple. All apertures in the room or space must be closed, and the room evacuated. The apparatus must be placed in the middle of the room, the lamp lighted and then left, the door being carefully sealed up. No attention is required after filling the apparatus and lighting the lamp, which, containing a definite amount of spirit, is allowed to burn itself out. On completion of vaporisation of the formaldehyde, the room should be left closed for about six hours. Repeated trials have shown that at least 2·5 grammes of formaldehyde must be generated for each 35 cubic feet of air space, if destruction of exposed micro-organisms is to be secured. This is the minimum; but, where circumstances permit, it is better to increase this amount. If as much as 5 grammes of formaldehyde gas per 35 cubic feet be generated, the period of exposure may be shortened to four hours, but where the lesser amount is generated the exposure must be quite six hours. The main essential for success with this and other generators is the vaporisation of a sufficient volume of formaldehyde solution. From our observations made upon a small room of 800 cubic feet capacity,

the vaporisation of 200 cc. of formalin diluted with 800 cc. of water is efficient, exposed bacteria being killed in each instance: this is equal to 74 grammes of formaldehyde, or, roughly, 3 grammes of active formaldehyde gas for 35 cubic feet of space. The dilution of the formalin with water is essential to prevent polymerisation and to secure sufficient moisture in the air. Two samples of air were withdrawn on two occasions from the room, after generation of this amount, in this manner and tested for formaldehyde; on the first occasion, which was a windy day, the amount recovered was 0·0299 gramme per cubic foot of air on the other, a relatively quiet day, the quantity recovered was 0·042 gramme per cubic foot, or an average of some 39 per cent. of that discharged into the air space. Trials were made by vaporising the formalin without dilution; that is, 500 cc. of formalin was placed in the retort and vaporised in the usual way. A number of germs exposed on strips of linen in the room were found to be still alive after five hours, while a sample of air withdrawn from the chamber, one hour after discharge of the formaldehyde, yielded only 0·016 gramme of formaldehyde, or some 7 per cent. of that theoretically and originally discharged: moreover, an examination of the retort showed the presence of much solid paraform, as indicated by a white caking. It was clear that, without dilution, polymerisation of formalin takes place with a consequent loss of disinfecting power; therefore, for efficient disinfection by means of this apparatus, preliminary dilution of the formalin is essential. The observations suggest that the degree of dilution should be as indicated above, namely, 1 in 5. If used in this manner, disinfection of exposed surfaces can be adequately secured by this "Torrent" generator, the amount of formalin to be used being half a pint, diluted with two pints of water for each 1,000 cubic feet of space. One of these vaporisers is capable of fumigating efficiently a cubic space of 4,000 feet, and when larger rooms have to be dealt with, two or more apparatus must be simultaneously employed. If used in a tent to secure disinfection of exposed articles, the tent must be soaking wet, well pitched, well laced up, and the quantity of formalin vaporised per 1,000 cubic feet trebled.

In cases where formalin is not available, a solution of formaldehyde can be prepared from the tablets of paraform, as supplied for the Alformant lamps. If crushed, they dissolve in hot water, especially boiling water, forming a nearly pure solution of formaldehyde, which can be vaporised in a similar way to ordinary formalin. When so dissolved, each tablet is equivalent to some 3 cc. of formalin.

Our own observations indicate that when solidified formaldehyde is used in this way to make a solution from which the gas can be volatilised in an active state, 100 tablets must be dissolved or placed in a litre, or 1¾ pints, of water, for each thousand cubic feet of space to be treated; this will give results closely comparable with those obtained by the vaporisation of ordinary formalin. For lesser or larger cubic spaces, the number of tablets taken and the volume of water in which they are to be dissolved must be calculated in the same proportion, on a basis of ten tablets in 100 cc. of boiling water for each hundred feet of cubic space. In tents these quantities must be trebled. Several observations with the "Torrent" vaporiser have been made, using this improvised solution of formaldehyde in place of formalin. The germicidal effects have been satisfactory, provided a sufficiency of tablets have been dissolved as previously laid down. Several tests were made to determine the amount of formaldehyde present in the air after generation in this manner. The mean of three experiments showed that each cubic foot of air contained 0·024 gramme of formaldehyde, representing roughly 27 per cent. of that originally discharged into the air. These results show that the degree of efficiency as indicated by available formaldehyde recoverable from the air, is not so high when the improvised solution, made by dissolving paraform tablets, is used, as with the volatilisation of ordinary formalin diluted in the proportion explained. In spite of this, the improvised solution from the tablets is practically an efficient re-agent, as judged by bacteriological observation.

The foregoing details are applicable equally to the employment of the "Lingner" lamp and the "Trenner-Lee" apparatus. These are simpler in principle, as vaporisers of formaldehyde, than the "Torrent," their main differences are in matters of detail of design. In "Lingner's" lamp the formalin or the aqueous solution of formaldehyde is projected by four nozzles from a central container as a fine spray, under the pressure of the steam developed in a ring boiler, and in streams so forcible that three pints of formalin and two pints of water are vaporised and distributed through a cubic space of 3,500 feet in half an hour. If the room or space operated on be kept closed for six hours on completion of the vaporisation, the sterilisation of all exposed surfaces is usually complete. A number of experimental tests have been made, using and exposing various micro-organisms already mentioned, and we have found this lamp to be handy, reliable, and safe. The various tests with exposed bacteria indicate that for

the killing of these micro-organisms so great an expenditure, as indicated above, as three pints of formalin for a space of 3,500 cubic feet is unnecessary. Satisfactory germicidal results have been obtained by the volatilisation of half that quantity of formalin, or practically half a pint to each thousand cubic feet of space, but the procedure is much slower. If used in a tent, the tent must be quite wet, and at least three times these quantities used. Some tests made as to the amount of formaldehyde present in the experimental room of 800 cubic feet capacity after the vaporisation of 250 cc. of formalin and an equal volume of water, the whole being equal to 94 grammes of formaldehyde, showed that after the lapse of an hour each cubic foot of air contained, as the mean of three observations, 0·049 gramme of formaldehyde, or rather more than 42 per cent. of the amount originally discharged. The vaporisation of a solution of formaldehyde made by dissolving the tablets of paraform in hot water was not equally satisfactory. A hundred tablets were dissolved in a litre of boiling water and driven off by the steam from a similar amount of water in the boiler. This represented 90 grammes of available formaldehyde; but two samples of air drawn from the room an hour later contained but 0·016 grammes per cubic foot, or only some 14 per cent. of that originally available from the solution placed in the lamp. These results suggest that the use of formalin only is advisable with this apparatus. Polymerisation is undoubtedly prevented by the manner in which the combined formaldehyde and steam are projected together into the air, as shown by the relatively large amount of formaldehyde recovered from each cubic foot of air. The lamp can be used from the outside of a room by adjusting through a keyhole a flexible metal tube with a nozzle, which is provided. Our best results have been obtained when the lamp has been worked within the room itself. One of these lamps can diffuse active formaldehyde through a space of 4,000 cubic feet, or one lamp is needed for each 400 feet of floor area.

The "Trenner-Lee" apparatus has also been tested by us. It works from either outside or inside the room to be disinfected. It consists of a heavy copper retort from which a known quantity of formalin or other aqueous solution of formaldehyde can be vaporised. The emerging vapour is practically superheated by the escaping products of combustion from the spirit lamp beneath. The destruction of exposed micro-organisms, such as *B. coli communis*, *B. typhosus*, *B. prodigiosus*, and *S. pyogenes albus*, was secured by the vaporisation of formalin from this apparatus, in

the proportion of half a pint for each thousand cubic feet of space. One of these vaporisers appears to be able to diffuse active formaldehyde through a space of 4,500 cubic feet; in all cases the room should be kept closed for at least six hours after completion of operations. On three occasions samples were drawn from an experimental room of 800 feet cubic capacity an hour after the volatilisation of 250 cc. of formalin diluted with one litre of water. This represented 94 grammes of available formaldehyde. The first sample taken on a calm day showed 0·052 gramme of the aldehyde in one cubic foot of air; on a second occasion with some breeze blowing, but otherwise a damp day, the yield per cubic foot was 0·045 gramme of formaldehyde; on a third occasion, when a very strong wind was blowing, the formaldehyde present in a cubic foot of air was but 0·016 gramme. On this occasion, various exposed bacteria were not destroyed. If we ignore this last result as having been given under very adverse atmospheric conditions, and take the first two as representative of ordinary circumstances, we may say from this apparatus that some 41 per cent of the formaldehyde originally present in the retort, is present in the air of the space into which it has been discharged.

Observations were made, using the paraform tablets dissolved in hot water in place of ordinary formalin. In these cases 100 tablets were dissolved in a litre of water and then volatilised into a room measuring 800 cubic feet. Assuming that in this form only 90 grammes of available formaldehyde would be available for discharge into the air space, this would represent 0·112 gramme per cubic foot of air. Samples withdrawn after an hour's interval, on two occasions yielded respectively 0·025 and 0·033 gramme of formaldehyde per cubic foot of air, or about one fourth of the original volume discharged. Bacteria exposed on the walls and other surfaces on three occasions, were effectively destroyed by the formaldehyde vaporised from this improvised solution, the period of contact being six hours. If used in a tent, that shelter must be soaking wet, and the amounts of re-agents used trebled, as compared with those found to be effective in buildings.

Under circumstances in which neither a special vaporiser nor a spray is available, the following process, suggested by Evans and Russell[1] will be found most efficient. The method consists in pouring formalin quickly upon fine crystals of potassium permanga-

[1] Evans and Russell. "Formaldehyde Disinfection," Thirteenth Annual Report, 1904. State Board of Health of Maine, U.S.A.

nate contained in a suitable metallic vessel; a vigorous action takes place in a few seconds, accompanied by a strong ebullition of the liquid and sufficient heat to produce a large quantity of steam. The reaction is over in a few minutes, and with a proper proportion of substances the residue in the vessel is almost dry.

The heat produced by the action of the permanganate on a portion of the formaldehyde is sufficient to evaporate nearly all the remainder. Analyses of the gas evolved by this reaction show it to consist of formaldehyde, water vapour, carbon dioxide, and traces of formic acid. In the generator are left a lower oxide of manganese, a little formaldehyde, carbon dioxide, potassium hydroxide, and some potassium formate. The precise nature of the decomposition is apparently according to the following reaction:—

$$4\,KMnO_4 + 3\,H_2CO + H_2O = 4\,MnO(OH)_2 + 2\,K_2CO_3 + CO_2.$$

From this equation it would seem that one-fifth of the formaldehyde is destroyed. The proportion of the two substances which gives the best results and the driest residue, is two parts of formalin to one part of permanganate. We have submitted this method to a large number of experimental observations and found it to be effective, simple, rapid, and, by virtue of the inexpensive apparatus required, preferable to the older and more cumbersome methods. For a space of 2,000 cubic feet, 285 grammes, or 10 ounces, of the permanganate and 570 cubic centimetres, or 1 pint, of formalin are needed, the re-agents being mixed or added the one to the other in an ordinary galvanised iron pail. The permanganate must be put in first and the formalin poured on to the crystals; a brisker decomposition of the formalin results if the crystals of the permanganate be finely crushed, but this is not essential, as the ordinary permanganate crystals are sufficient. After placing the two re-agents in the pail or other metal vessel, some seconds elapse before evolution of formaldehyde begins, and there is ample time for the operator to withdraw from the room, which should be left closed for quite six hours. While making observations on the bactericidal efficiency of this method we have on three occasions drawn samples of air from the room operated upon, after a lapse of an hour from generation of the free formaldehyde. The first sample taken on a quiet day, with no wind, after the decomposition of 250 cc. of formalin by 125 grammes of permanganate in a room of 800 cubic feet, yielded 0·04 gramme of the aldehyde in a cubic foot of air. On another day, when a fair breeze was blowing, the same quantities of formalin and permanganate decomposed in the

same room as before, gave 0·031 gramme of formaldehyde per cubic foot of air. On a third day with a high wind blowing, but otherwise similar conditions as to amount of re-agent used, the amount recovered from a cubic foot of air was but 0·02 gramme. These results indicate that of the original amount of formaldehyde generated, some 33 per cent. was present at the end of an hour on a quiet day, only some 25 per cent. on a breezy day, and but 16 per cent. on a very windy day. On the first two occasions all exposed bacteria were killed by the formaldehyde generated, but on the third occasion all the specimens exposed were not satisfactorily killed. In cases where formalin is not available, as in camps and other places where liquid re-agents are not readily transportable, a working solution of formaldehyde can be made from the ordinary tablets of solid paraform. These need to be crushed to a powder and then placed in hot water; the liquid is then brought rapidly to the boil. This is now a hot solution of formaldehyde, and should then be poured on to so much permanganate in a suitable vessel, as already explained. From our own experiments, we find that practically one hundred tablets, if crushed and then dissolved in a pint of boiling water, make a solution of formaldehyde equivalent to 300 cc. or, say, half a pint of ordinary formalin. If this boiling solution be poured upon 10 ounces of permanganate crystals, sufficient formaldehyde vapour in an active form is liberated to secure the same disinfecting results as would be obtained by pouring half a pint of commercial formalin on to 5 ounces of permanganate. For a space of 2,000 cubic feet, or, say, from 180 to 200 square feet of floor area; the solution of two hundred tablets, after crushing, should be made in from one and a half to two pints of boiling water, and this solution poured on from 15 to 20 ounces of permanganate. In all cases the amount of permanganate needed is exactly half the weight of the liquid added, that is, 600 cc. of formalin need 300 grammes of permanganate, and two hundred tablets dissolved in 30 ounces of water require 15 ounces of the crystals. Experiments made to test the germicidal power of this solution of formaldehyde prepared from paraform tablets, have shown that, if used in the proportions indicated, it is as efficient as ordinary formalin. Only on one occasion have the formaldehyde contents of the air been tested after treatment by this method. On this occasion 100 tablets had been dissolved in a pint of water and poured over 10 ounces of permanganate crystals placed in a pail in a room of 800 cubic feet capacity. Theoretically, the decomposition meant the liberation

of 90 grammes of formaldehyde, equivalent to 0·112 gramme per cubic foot of air. The sample withdrawn an hour after commencement of vaporisation gave 0·029 gramme, or about 26 per cent. of that originally omitted. It may be noted that the day was calm, without any excessive chances of leakage or air dilution. In camps or tents, these quantities must be trebled and the canvas thoroughly soaked.

For the rapid disinfection of a limited amount of clothing we have found the following procedure as efficient as it is simple and easy to carry out. Obtain a well-made box or trunk whose lid fits closely. Make a rough estimate of its cubic capacity. Place the articles to be treated inside, taking care not to pack them or press them down, but let them lie simply as they fall or are dropped in. At one corner of the box, or in any convenient part, place the metal container in which the necessary decomposition of the formaldehyde solution is to be secured. Into this container put the permanganate crystals and then add the formaldehyde solution. The box may now be closed and rendered as air-tight as possible, and left for from three to four hours. For a box containing 5 cubic feet, the use of 2 ounces of formalin with 1 ounce of permanganate is sufficient; or if the tablets are employed then twenty of them dissolved in 8 ounces of boiling water; this is then to be poured on to 4 ounces of the permanganate.

In other cases a cupboard can be utilised for the same purpose, and, if the door be close-fitting and other precautions taken to render it more or less air-tight, the disinfection of many small articles of clothing can be secured. For articles that will not stand subjection to disinfection by steam this method affords an efficient procedure. For a cupboard measuring 80 cubic feet, and capable of being rendered fairly air-tight, the decomposition of 4 ozs. of formalin by two ozs. of permanganate crystals will be found effective for the destruction of bacteria and other infective matter on clothing. The procedure is less reliable against ordinary vermin, but, with care, even these parasitic forms can be destroyed by this method. Where this is desired, the best procedure to adopt is to generate the formaldehyde by the permanganate formalin method, inside either a warm oven, or, better still, inside the chamber of an ordinary steam disinfector, calculating the amount of reagent required according to stove space. For an ordinary disinfecting stove, 6 ounces of formalin decomposed by 3 ounces of permanganate will suffice at 120° F. in a moist atmosphere to kill ordinary vermin in clothing by a contact of three hours. So

soon as the doors and all exhaust or other apertures from the stove have been closed, the temperature of the chamber should be raised to and maintained for three hours at 120° F. This temperature increases the insecticidal activity of the aldehyde, and can be further exalted if a small quantity of steam be discharged into the hot chamber, sufficient to moisten the contained air. Garments, which would be damaged by ordinary steam disinfection, can be effectually rid of vermin by this method.

In attempting to form an opinion as to the relative merits of these various methods of disinfection by formaldehyde, we have to remember that although all are capable, under certain essential conditions, of disinfecting exposed surfaces, yet those conditions essential to success are not in every case readily attained. A fundamental rule to be borne in mind is that efficient disinfection by formaldehyde is dependent on the two physical factors of heat and moisture. In a very dry or very cold atmosphere disinfection by formaldehyde is unreliable, the optimum conditions being a temperature of 70° F. and a percentage humidity of 70. Take the case of disinfection by a spray of formaldehyde solution. This is undoubtedly efficient if carried out properly; that is, using at least 1 gallon of a 2 per cent. solution of formaldehyde for each 600 square feet of surface, and taking care to completely cover the whole of that surface with the re-agent working from below upwards. As already pointed out, this means a laborious undertaking, and unless supervised the work is invariably scamped and consequently valueless. For this reason the opinion is formed that as a routine procedure it is impracticable except for small rooms. Moreover, in large garrisons, unless some two or three sprayers are available, the use of this method is impossible.

The volatilisation of paraform tablets by means of an Alformant lamp is a popular procedure, as it is comparatively simple and entails no undue labour on the part of the operator other than pasting up cracks and holes. But to be efficient, attention must be paid to the degree of humidity and temperature. These factors must be determined by the use of wet and dry bulb thermometers. The best results will be obtained only at a room temperature over 60° F., preferably at 70° F., and with a percentage moisture of 70. On a cold, dry day disinfection by this method is certain to be inefficient. Care needs to be taken, under such circumstances, to warm the air space or room, and also to evaporate some water antecedent to or concurrently with the votalisation of the paraform tablets. How often can this be done, or is it done? Then, again,

some half dozen of these lamps must be available, especially where large barrack rooms are the place of operation. The futility of having only one of these lamps on charge and available in garrisons of any magnitude is obvious.

The use of special vaporisers, such as the "Torrent," the "Lingner" and the "Trenner-Lee," offers fewer risks of failure; but even these need to be used with intelligence and care. The operator must in the first place see that the room is reasonably air-tight and adjust the volume of re-agent used in accordance with the conditions, whether it is a calm or a windy day, as the facts disclosed indicate this to be a disturbing condition. The use of these special vaporisers is not recognised in our Service, but they probably present the most efficient type of formaldehyde generator. Which of the three is the better, is open to argument. Speaking from personal experience, probably the Trenner-Lee is the better adapted for Army needs. The percentage figure as represented by amount of formaldehyde recovered from a cubic foot of air indicates the "Lingner" lamp to be more efficient when using formalin, but this is discounted by the low figure yielded when an improvised solution of paraform tablets was vaporised. For Service needs we require an apparatus capable of using both kinds of formaldehyde solution effectively. In these respects there is little to choose between the "Trenner-Lee" and the "Torrent" generator.

For all round utility, simplicity and efficiency we are disposed to favour the formalin-permanganate method. It requires no special apparatus, an ordinary metal pail being sufficient, while the actual re-agents used are readily available. It has been much used in the Aldershot Command. In camp, or where formalin is unattainable, improvised solutions of formaldehyde can be prepared, as explained, from the paraform tablets. Whatever solution is used the amounts laid down for efficiency in buildings must be trebled for camp work, the tent in all cases being saturated with water. Whether there is any real need to disinfect or attempt to disinfect rooms by these or other methods is open to doubt. In the majority of cases of infectious disease, infection is conveyed by the person or clothing and bedding, and is not contracted from walls, ceilings or fittings of buildings. From this point of view we are disposed to regard the routine fumigation or, so-called, "disinfection" of rooms and quarters after the occurrence of infectious disease to be unnecessary, a constant source of disturbance, and inconsistent with modern conceptions of the etiology

of these diseases. We should like to see it boldly abandoned as a relic of medical empiricism, and the true line of defence against the spread of infection recognised as being thorough disinfection by steam of all clothing, bedding and other fabrics which have been exposed to infection. The adoption of this attitude is at once logical and scientific, and its official enforcement would do much to educate public opinion as to the true value of the act of disinfection, and at the same time relieve the profession of medicine of the aspersion that its daily practice is not free from charlatanism.

For an effective disinfection by formaldehyde the following conclusions may be formulated: (1) In all cases an average of 5 grammes of absolute formaldehyde per cubic metre, or 14 to 16 grammes per 100 cubic feet, should be used with six hours' action or contact; (2) in exceptional cases, where loss of formaldehyde cannot be avoided, or when numerous objects, or a good deal of matter of an organic nature which cannot be conveniently removed, are present in the room, the quantity of formaldehyde should be doubled; (3) in all cases where the room temperature is below 50° F. it should be raised; from 60° to 70° F. is an efficient temperature; (4) the strength of the formaldehyde solution should be known.

Recent information suggests the possibility that for the preparation of improvised solutions of the aldehyde the use of festoform tablets may be better than those of paraform. We have not had an opportunity of trying these tablets, but they appear to be a combination of the inert aldehyde with an alkaline soap, each tablet being equivalent to 0·5 gramme of active formaldehyde. Results reported by Xylander[1] indicate that 376 of these festoform tablets dissolved in a litre of water and representing 188 grammes of formaldehyde, were efficient, when volatilised, for disinfecting a space of 1,000 cubic feet. These experiences are analogous to those obtained by paraform tablets; the festoform tablets would appear to be weaker than the paraform tablets, but have the advantage of being more soluble. In submitting this memorandum an attempt has been made to summarise the essential details as to disinfection by formaldehyde in the hope that the facts, as ascertained, may furnish the basis of a better system of disinfection methods in the Service.

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[1] *Arbeiten auf d. Kaiserlich. Gesundheitsamt.* Bd. xxvi., Hft. 2, 1907.

A NEW METHOD OF CARRYING WOUNDED OFF THE FIELD ON SERVICE.

By Captain J. S. O'NEILL.
Indian Medical Service.

The following is a description of certain simple and effective arrangements by which wounded men can be carried off the battlefield. The only appliances necessary are field-service puttees and rifles. I shall describe three methods: (1) By means of one puttee; (2) by means of two puttees; (3) by means of two puttees attached to two rifles.

Fig. 1.—Method No. 1. Applying one puttee.

(1) *Method by Means of one Puttee.*—A puttee is unrolled and placed well forward under the buttocks of the wounded man, and tied by a reef-knot into a loop 84 to 88 inches in length (*vide* fig. 1). The rescuer then bends down, facing away from the injured man, and applies the loop of puttee over his own forehead (*vide*

fig. 3) (or he applies the puttee around the back of his neck, below the collar of his coat behind, and over the hollows of his shoulders in front). By this means the wounded man is carried (*vide* fig. 2). The time employed in applying a puttee in this manner is fifteen seconds.

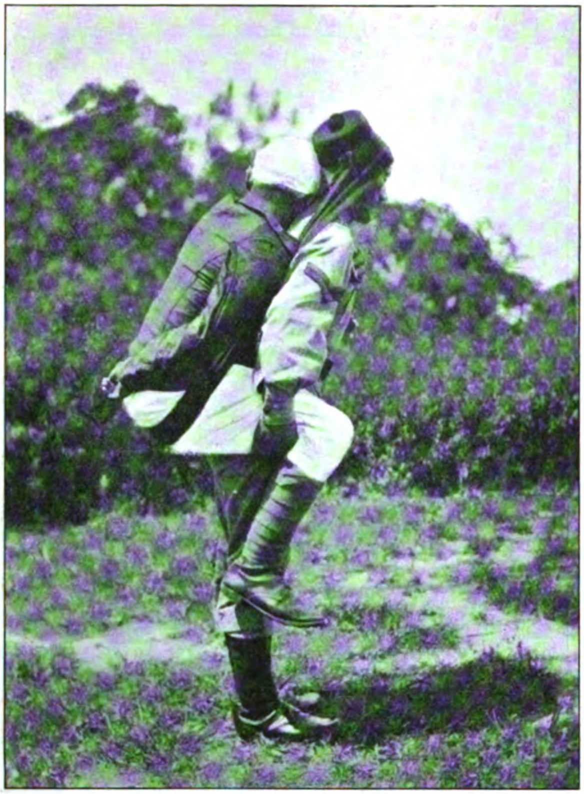

FIG. 2.—Method No. 1. Using one puttee.

(2) *Method Requiring two Puttees.*—(*a*) One puttee is placed under the buttocks of the wounded man and over the forehead (or around the nape of the neck and over the shoulders) of the rescuer, as in the first method. (*b*) The second puttee is passed outside the first, round the middle of the back and under the armpits of the wounded man, under the armpits and over the front of the chest of the rescuer, and tied off at one side by a

reef-knot, thus forming a loop 72 inches in length. The time occupied in applying these two puttees is twenty-two seconds.

By these means wounded men can be carried with great ease for considerable distances (one to two miles). They are especially useful over broken country and in hill warfare, but equally so in the plains, the hands of the rescuer being free to carry rifles.

Fig. 3.—Method No. 2. Using two puttees.

Figs. 2 and 3 show the method of carrying with the puttee applied over the forehead. The puttees used were of the field service pattern, khaki; length, 9 feet 3 inches; breadth, 4½ inches; tape, 6 feet in length; breaking strain, 232 lb. (16 stone 8 lb.). When two puttees are employed, only about two-thirds of the weight is on the lower puttee.

(3) *Method Requiring Rifles and Puttees.*—Two puttees are

applied to two rifles, forming nine bands from muzzle to butt (*vide* figs. 4 and 5). The rifle bolts are removed and the cartridges withdrawn. The two rifles are placed with their trigger-guards uppermost, the two puttees being knotted to the rifles so as to form nine cross-bands uniting the rifles, thus forming an improvised stretcher.

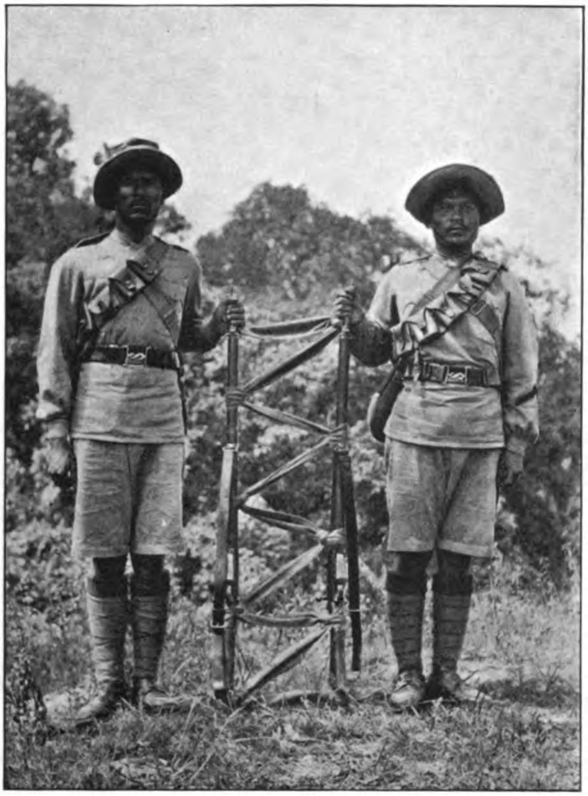

Fig. 4.—Method No. 3. Showing how the two puttees are applied to two rifles, forming nine cross-bands.

The first cross-band passes from the muzzle of one rifle to the piling-swivel of the other; the second cross-band from the piling-swivel of one rifle to midway between the "upper band" and the "lower band" of the other; the third cross-band from midway between the "upper" and the "lower band" to the "lower band"; the fourth cross-band from the "lower band" to the

hand-guard; the fifth band from the hand-guard to the front of magazine. The second puttee is then knotted to the first. The sixth cross-band runs from the front of the magazine to the small of the butt; the seventh band from the small of the butt of the one rifle to the small of the butt of the other rifle; the eighth cross-band from the small of the butt to the butt-swivel; the ninth cross-band between the two butt-swivels. The puttees are applied to the rifles by a simple hitch, and fastened to such parts of the rifle as will

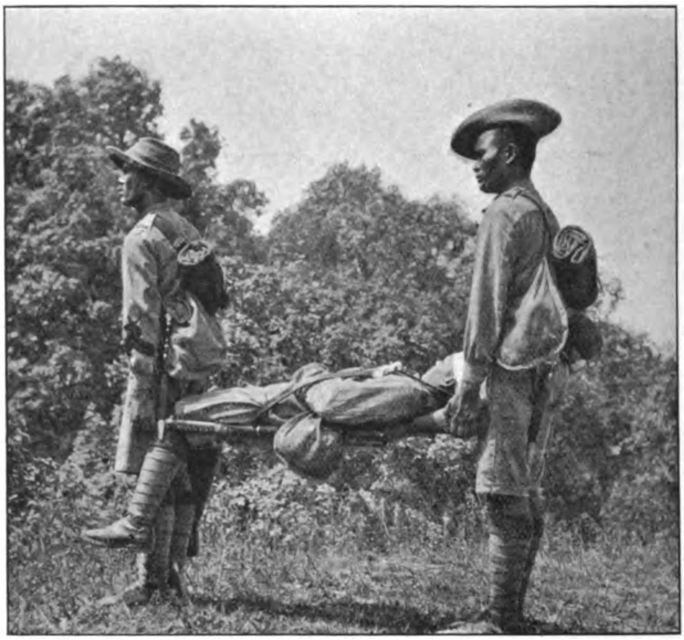

FIG. 5.—Method No. 3. Two puttees applied to two rifles, forming a stretcher. The rifle straps are tied across the chest of the wounded man by a piece of bandage.

prevent slipping. The stretcher thus formed by the puttees has a length of about 44 inches, and a breadth of about 15 inches.

This method of carrying wounded by means of rifles is useful where men are seriously injured. The head can be kept level, being at the butt-end, and the legs allowed to hang down at the muzzle-end of the rifles. The slings of the two rifles can be tied over the chest of the wounded man by means of a piece of bandage, &c., when carrying over rough country (*vide* fig. 5). Transport by this method has been carried out for a distance of over 700 yards.

The time employed in applying the puttees is less than one and three-quarter minutes.

These three methods are specially useful in "the hills" or over broken country, but are also very convenient in the plains if no stretchers or other appliances are at hand. The advantages claimed are: (*a*) All men on service being supplied with puttees and rifles, no extra transport appliances are necessary; (*b*) the great ease with which wounded men can be carried for considerable distances without fatigue. In methods (1) and (2) only one man available for duty is taken from the field, and in method (3) only two men are temporarily absent.

Experiments have been carried out with these methods during the last eight months, with satisfactory results. The men, with practice, can apply the puttees with great rapidity, and the methods can easily be taught to all the men in a regiment either of the British or of the Indian Army.

ATOXYL AND ITS VALUE IN THE TREATMENT OF SYPHILIS.

By Major W. A. Ward.
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In the ~~*British Medical*~~ *Journal* for December, 1907, Colonel Lambkin had an article on the use of "atoxyl" in the treatment of syphilis. At that time little was known as regards the action of this drug in syphilis, its use being quite a new method of treatment. The efficacy of atoxyl against sleeping sickness, a disease caused by a protozoon, led to the conclusion that this remedy might be equally efficacious against other protozoal diseases, and as the protozoal nature of syphilis has been acknowledged since the discovery of the *Spirochæta pallida* by the late Dr. Schaudinn, atoxyl was tried as a remedy against this disease. At the time the above article was written, the results were based on four cases of syphilis which had been treated by this drug; but, although they had only been so treated for a very short time, and had only received comparatively small quantities of the drug, Colonel Lambkin nevertheless considered that the results were sufficiently encouraging to justify a continuance of the treatment.

Accordingly, from that date all fresh cases of syphilis were treated by this method, and in order that the action of the drug might be more closely studied and that no doubtful case should be so treated, only those cases were selected for treatment which had definite confirmatory symptoms of syphilis, such as rashes, ulceration of mucous membranes, condylomatous growths, &c. A sore, with only induration of the lymphatic glands, was not considered sufficient evidence of syphilis for purposes of this treatment, and the present article. Moreover, none of the cases so treated have received any other form of anti-syphilitic treatment; not one of the cases has even had a dose of potassium iodide. One is thus justified in claiming that the results are entirely due to the action of atoxyl, whereas most of the Continental writers on this subject have combined some other drug in the treatment.

A certain amount of literature on the treatment of syphilis by atoxyl has appeared in some of the French and German medical journals. M. Salmon, Professor Lassar, Professor Hallopeau and M. Balser are the principal authorities who have worked with and written upon this treatment. But the doses which have been

considered sufficient, the results of treatment, and, what is much more important, the grave complications which have been noted as following on the administration of the drug, differ very considerably from one another. It is unfortunate that this should be the case, but the reason is not difficult to understand when one considers the varying conditions which have attended the administration of the drug.

Professor Hallopeau has recorded symptoms of intolerance after a varying number of injections and doses. These symptoms consist in gastro-intestinal pains, nausea, vomiting, general malaise, painful sensations in the limbs and painful micturition. He states that, though these symptoms are generally mild and transient, they may, in exceptional cases, take on an alarming character. They can be avoided by limiting the injections to a small number, by using large doses for the first two injections only, by leaving an interval between each successive injection, and by stopping the injections as soon as abnormal sensations appear. He also states that old people, and patients of small stature or who have organic affections, are predisposed to these untoward effects, and should be given smaller doses. In his earlier cases, Professor Hallopeau gave two injections of 0·75 gramme each at two days interval, and then four further injections of 0·50 gramme each, at intervals of three days between each, that is, about 50 grains in the course of twenty days.

But much more serious symptoms than the above have been reported after a course of atoxyl. At a meeting of the Académie de Médecine, held in July, 1907, Professor Hallopeau discussed a case which had been reported by a foreign colleague. The case was that of a woman, aged 47. She had received 5·10 grammes (about 76 grains) of atoxyl during twenty-six days by intra-muscular injection; a few days after the last injection she developed some visual trouble, and followed fourteen days later by complete amaurosis. Examination of the fundus revealed nothing except a small focus of choroiditis. Hallopeau considered that the blindness was due to the atoxyl, though he admitted that there were extenuating circumstances, viz., alcoholic neuritis. He also considered the dose a large one, and that it would have been better if it had been spread over thirty-nine days instead of twenty-six. He further stated that the atoxyl was of *foreign* (*sic*) origin, and some chemical experiments which had been made by M. Duret on some samples of atoxyl showed the presence of free arsenites and arseniates, bodies which are eminently toxic.

It is important to note that Hallopeau, speaking from his own

personal observations founded on 130 cases treated in the St. Louis Hospital, said that he had not had one case of visual trouble (*French atoxyl being used*), whereas of twelve cases treated at the same time with atoyxl of *foreign* origin, two suffered from some visual disturbance, and added that it would appear that atoxyl of foreign origin did not act in the same way as atoxyl of French origin. He went on to say that those were not the only cases of ocular trouble where atoxyl had been administered, and recalled one such where amaurosis had supervened after the drug had been given for three consecutive months. On the other hand, he said that atoxyl had been given in enormous doses in cases of sleeping sickness, as much as 55 grammes in a few weeks; and referring to the conference which had been held in London for the prophylaxis of sleeping sickness, pointed out that M. Ayres Kopke, of Lisbon, had seen six cases of visual affection in fourteen cases treated by atoxyl, three of which became blind. Gama Pinto found optic atrophy in these, while in another case there was unilateral hemianopsia; the minimum dose given had been 5·50 grammes.

In view of these facts, Hallopeau recommended that the second series of injections should not be given until the arsenic administered in the first series has been completely eliminated. He stated that he had sometimes met with symptoms of gastro-intestinal intolerance after the fourth injection, and advised a pause after the third injection, quoting cases in favour of this restricted treatment where there had been notable amelioration of the symptoms, and, in one case, a total disappearance of a papulo-squamous syphilide after one injection. He did not recommend that the drug should be pushed till all syphilitic manifestations had disappeared, but considered that it would attenuate the intensity of the disease. As a routine practice he recommended three injections of French atoxyl in decreasing doses: first 0·75 gramme, two days later 0·60 gramme, and three days after that 0·50 gramme. After waiting ten days he began a course of mercury for sixty days and then a course of iodides if necessary. At a former meeting of the Académie de Médecine, he had recommended that the treatment by mercury and atoxyl should be carried on simultaneously, but subsequently found that he was wrong, for corrosive sublimate dissociates the atoxyl and may give rise to accidents. Before beginning mercurial treatment it is well to wait for fifteen days, till the atoxyl is eliminated from the system.

M. Laveran, referring to the cases noted by M. Ayres Kopke, said that those cases which had become blind were not those

which had received the largest doses of atoxyl, and attributed the unfortunate result not to the atoxyl but to its German source.

Koch, referring to his investigations into sleeping sickness and its treatment by atoxyl, relates that curious symptoms were noticed on increasing the daily doses of atoxyl from a half to a whole gramme. Several cases of sleeping sickness thus treated, after complaining of pains and giddiness, became completely blind and remained so.

Various other writers have recorded toxic symptoms or symptoms of intolerance after comparatively very small doses, when the drug has been administered in cases of sleeping sickness.

Daniels states that "burning on micturition, general dryness of the mucous membranes and skin, with the formation of pruriginous vesicles," followed the administration of 0·2 gramme of atoxyl twice weekly for fourteen months in one case, while, in another case, vomiting and diarrhœa occurred early in the course of treatment.

Van Campenhout states that untoward effects followed the administration of 0·8 gramme of atoxyl. He describes the symptoms of poisoning as slowing of the pulse, cold extremities, and pectoral cramps.

O. Waterman, writing in the *Berlin. Klin. Wochenschrift*, September 2nd, 1907, comes to the conclusion that atoxyl has not proved itself of benefit in the treatment of syphilis, since the drug affects the optic nerve and the central nervous system, causing blindness. He is opposed to the use of this drug in cerebral syphilis and in tabetic optic atrophy, in both of which conditions it is capable of diminishing the sight, either by the formation of a central scotoma or by its general action. He also states that he has observed a sudden attack of intestinal catarrh and jaundice, due, he believes, to atoxyl; while in another case he met with the onset of a peculiar nervous disturbance which disappeared as soon as the drug was discontinued. He found that most of the patients treated with atoxyl, complained of pains in the arms and legs, general weakness and loss of appetite.

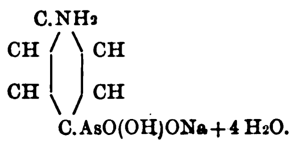
From the above it will be seen that in atoxyl we have a drug which is, at times and under certain conditions, at present not quite understood, capable of causing the gravest symptoms and consequences, and that it is necessary, when administering this drug, to act with the greatest caution and care. It may, therefore, not be out of place to state what is known of atoxyl, and, if possible, to throw some light on the question of what is the

determining cause of the grave symptoms which have manifested themselves when this drug has been used by different observers.

It is important to remember that the word "atoxyl" is a proprietary word, and legally can only be used by one particular firm for their special preparation. This is a German firm, the Vereinigte Chemische Werke, Charlottenburg, for whom Messrs. R. W. Greef and Co. are the London agents. It is unfortunate that many preparations, manufactured according to the chemical analysis, have been put on the market. It may very fairly be claimed that these various preparations differ materially from one another. It is only on these grounds that one can account for the varying results and symptoms which have been recorded by various writers; and it would have been much better if instead of stating that the atoxyl was of French, German, or foreign origin, the exact source of the preparation used had been stated. At present it is impossible to contrast results, as in nearly every case different preparations have been used. It may be of some service to here, give briefly, what is known with regard to so-called "atoxyl," as regards its chemical composition, its properties, and therapeutic action.

Atoxyl was introduced about five years ago, and was said to be a meta-arsenic anilide, having the formula $C_6H_5NHAsO_2$, and containing 37·69 per cent. of arsenium. It was highly praised by the manufacturers, on the ground that it provided a means of administering, apparently, unlimited amounts of arsenic without producing toxic effects. Analysis showed, however, that atoxyl contained only 25·77 per cent. of arsenium. From the analysis and reports of other investigators it has been concluded that atoxyl is really the sodium salt of arsenic acid in which one hydroxyl radicle of arsenic acid has been replaced by the aniline radicle. Agreeing with this, the manufacturers adopted the formula $C_6H_4(NH_2)\ (AsO.OH.ONa)_2$ as indicating the composition of the substance. The analysis referred to showed the presence of three molecules of water, but other experimenters found varying quantities of water.

Ehrlich and Bertheim state that the constitution of atoxyl may be represented by the formula—



The *Codex of the British Pharmacopœia* gives as a synonym for atoxyl, sodium anilarsinate, and the formula $C_6H_7NAsO_3Na2H_2O$, and says it is the mono-sodium salt of ortho-arsenic acid anilide, and contains 27· 3 per cent. of arsenium.

Atoxyl is a white crystalline powder with a refreshing taste; it is soluble in about six parts of cold water, and is readily soluble in boiling water. When dehydrated it dissolves readily, but when anhydrous with difficulty, in methyl alcohol.

Tests.—A 10 per cent. solution of atoxyl gives with ferrous sulphate an olive-green precipitate; with mercuric chloride a white precipitate; with nickel chloride or sulphate of magnesium, at first, a clear white solution, but later a crystalline precipitate. The careful addition of mineral acids to solutions of atoxyl precipitates out the free arsenic acid, which, however, is soluble in excess of the acid. The most sensitive test is the mixture of hypophosphorous and hydrochloric acids originally introduced for the detection of arsenic in glycerine, viz.:—

Sodium hypophosphite	1 part.
Water	1 ,,
Hydrochloric acid	10 parts.

This test will show the presence of 0·05 milligramme of atoxyl by the production of a deep brown precipitate on warming. By this latter test the presence of 10 milligrammes of atoxyl in 250 millilitres of urine is easily detectable. This test can be modified by adding to the mixture of the solution and reagent one or two drops of $\frac{N}{10}$ Iodine solution. This so increases the delicacy of the reaction that it will detect 0·02 milligramme of arsenic acid.

The question of how atoxyl acts when introduced into the body has not yet been decided, though the subject is an important one and gives much scope for investigation. Hallopeau thinks "it is highly probable that atoxyl introduced into the organism breaks up, after a certain time, into toxic products," and says, "it is impossible to explain otherwise the sudden onset of symptoms, frequently without any premonitory phenomenon; and the question arises whether it is possible to determine what part is played by the aniline and what by the arsenic in the genesis of these accidents."

It is generally agreed that atoxyl accumulates in the organism, but is eliminated fairly rapidly. Investigations are at present being made at the Royal Army Medical College to determine how soon after an injection atoxyl may be found in the urine, and how many days after an injection it may still be excreted in the urine. Atoxyl should not be given by the mouth, as it is broken up by

the acid contents of the stomach, and the effects of over-treatment by arsenic are thus more easily produced. Solutions of atoxyl break down and become yellowish if exposed to light. It is advisable that the solution should be freshly prepared each time before using it, as, if kept, it is liable to undergo spontaneous changes and dissociation and may give rise to very poisonous by-products. Dr. Nierenstein found that pure aniline is present in solutions of atoxyl which have been exposed to diffuse daylight for five days. It is said of atoxyl that similar changes occur in its composition, if the drug be heated to 100° C. for a few minutes.

The series of cases at the Military Hospital, Rochester Row, London, have been treated with a preparation made by Messrs. Burroughs Wellcome and Co. This preparation was obtained as follows: A new acid was prepared from aniline and arsenic acid having the composition $C_6H_8O_3NAs$. It was believed to have the chemical constitution $C_6H_5NHAsO(OH)_2$, and was therefore called ortho-arsenic-anilide. A neutral sodium salt was also prepared which was considered to have the formula—

$$C_6H_5.\ NH.\ AsO \left< \begin{matrix} OH \\ ONa \end{matrix} \right. ,\ 5\,H_2O.$$

These substances have recently been shown to have different structural formulæ to those given, for the point of attachment of the arsenic acid residue to the aniline residue is not through the amino group, but through the carbon atom of the benzene ring in the position para to the amino group. The corrected formulæ and names for the acid and salt respectively are therefore :—

$$NH_2C_6H_4\ \ As \begin{matrix} \diagup\ OH \\ =\ O \\ \diagdown\ OH \end{matrix}$$

Para-amino-phenyl-arsonic-acid.

$$NH_2C_6H_4\ \ As \begin{matrix} \diagup\ OH \\ =\ O \\ \diagdown\ ONa \end{matrix} + 5H_2O$$

Sodium-para-amino-phenyl-arsonate.

It is this latter preparation which has been used by us in the treatment of syphilis, with results which have been most satisfactory and in some cases remarkable.

As was stated above, only those cases which had very definite confirmatory symptoms of syphilis were treated by this drug, which for purposes of this paper will no longer be called atoxyl, but sodium-amino-phenyl-arsonate.

Up to the present time thirty cases, some of them very severe and marked cases of syphilis, have been so treated, and a total of 2,256 grains of the sodium-amino-phenyl-arsonate has been given, or an average of 75 grains to each patient.

In view of the experience of others who have used so-called atoxyl, and the symptoms of intolerance and toxicity recorded by them after the administration of comparatively small doses, it is a very interesting fact that, so far, we have not had one single case in which the patient has complained of any symptom which could be caused by the administration of this drug. On the other hand, all the cases have done remarkably well. They have gained in weight almost immediately after they have come under treatment and when their ordinary diet had not been supplemented by "extras." The beneficial action of the drug would appear to be most marked in those cases where there is ulceration of the mucous membrane of the mouth, tongue or throat. In five cases of the thirty, this was a very marked and prominent symptom, but a marked change in the condition was noticed even after the second injection, by which time the ulcers had already assumed a much cleaner condition and healthy granulations had appeared. In the course of a week, what had been a foul, dirty syphilitic ulcer had completely healed. The action of the drug was also well marked in three cases of vegetating condylomata, one of which was a most severe case, and the marked manner in which it yielded to the drug is my only apology for describing the case rather fully.

Gunner S., Royal Garrison Artillery, aged 39, reported sick October 29th, 1907. His history was indefinite, and he stated he had not noticed anything unusual till four days previously, when someone told him that he had spots on his face. When examined the whole of the scrotum and adjacent portions of the thighs were covered with large condylomatous masses; those on the thighs standing out at least a quarter of an inch from the surrounding surface, and from an inch to two inches in circumference: they were quite moist and covered with a mucoid discharge. The perinæum and the skin around the anus extending on to the contiguous portions of the buttocks, were also covered with large, foul condylomatous growths. The whole of the body, chest, abdomen, legs, face and arms were covered with large dullish red papules. The patient had a typically syphilitic and cachetic appearance, and looked very ill. The tip of the prepuce was hard and cicatrised, and there was the scar of an ulcer on the glans penis. The smell from the patient was most offensive. He had

all the symptoms of being an alcoholic subject, the tongue was very dirty, and there was a fine muscular tremor of the fingers. The urine contained a trace of albumin. This patient must have had syphilis for at least three or four months. His weight was 12 st. 6 lb.

On October 30th, 1907, the patient was given an injection of the sodium-amino-phenyl-arsonate, 6 grains, and this dose was continued every alternate day until he had had eight injections. Five days after the first injection there were signs that the condylomata were disappearing, and on the tenth day there was a marked general improvement; the rash was disappearing, the condylomatous growths were smaller and drier, and no albumin was found in the urine. By the eighteenth day, when the injections were stopped and the patient had received 48 grains, the rash had quite disappeared, and the condylomata had almost gone. The injections were now discontinued for a time.

By November 25th all the symptoms had quite disappeared, and the patient was much better and had gained 2 lb. in weight.

On December 13th there was some ulceration at both corners of the mouth, and the scars of the growths on the thigh and scrotum were showing brighter and a little elevated from the surface. The patient had not had an injection for twenty-five days, so the treatment was begun again, viz., 6 grains every other day till he had had six more injections. After the fourth injection the growths had quite disappeared again and the ulcers at the angles of the mouth were healing.

On December 18th the weight had risen to 12 st. 13 lb.

On December 23rd the second course of injections was stopped, and the patient was practically free from all symptoms of the disease.

On January 13th, 1908, there was some slight ulceration of the throat, so a short course of injections was again given, this time 9 grains on alternate days till four injections had been given.

On January 24th the patient was quite free from all symptoms, he felt and looked well, his weight being now 13 st. 2 lb.

On January 27th, as the patient had for some time now become "time-expired," and was anxious to get away, he was discharged from hospital, and unfortunately we shall not be able to follow up the case.

This case was a most instructive one, as one was able to watch so closely the action of the drug and how long its effect continued after an injection. The progress made by the patient was remarkable. He received in all 132 grains, and gained 10 lb. in weight.

Notwithstanding the comparatively large quantity of the drug injected, he did not at any time have the least symptom of intolerance, and one is inclined to the view that he made quicker progress than he would have done if treated with mercury. The case is also interesting, since Hallopeau and others have stated that "secondary associated infections, such as those which give rise to vegetating condylomata and certain suppurations, appear to be refractory to the treatment, as also are syphilitic deuteropathies, and leucoplasias of the tongue." Our experience does not at all agree with these statements, for those are the very cases which have done so remarkably well.

As regards the effects of this sodium-amino-phenyl-arsonate on the rashes which have been met with in the cases treated, we have been disposed to think that in some cases the duration of the rash was prolonged, and that in many cases its character was considerably altered. This was noticed in those cases which did not come under treatment soon after the symptoms developed, and in which the eruption was of a papular character. Injections of the drug, though they quickly healed up any ulceration of the mucous membrane of the mouth or throat, appeared to make the papular character of the eruption more marked, and in most of these cases the papules first became larger, and then squamous in character. They persisted for some time in spite of the injections of the drug being continued. After some considerable time the scales separated, leaving a dry and more or less "cracked" condition of the papule, which later disappeared altogether. This condition was noticed in several cases and was quite unlike anything we had seen before; it may be due to the well-known action of arsenic on the skin in some cases. Radcliffe Crocker, in his book on "Diseases of the Skin," states: "Arsenic may cause a papular rash on the face, neck and hands, morbilliform or like a papular syphilide. The papules are few, small, and separate at first, but subsequently in groups; the groups enlarge and coalesce into patches." Crocker further adds: "Meneau includes in the list of eruptions following the administration of arsenic, pruritus and general or local desquamation. This apparent influence of the drug on some of the syphilitic eruptions, noted above, is a very interesting condition and will be carefully watched.

Although comparatively large doses of arsenic in the form of sodium-amino-phenyl-arsonate have been given, none of the cases have shown any signs whatever of the well-known symptoms following the administration of arsenic, such as pigmentation, keratosis, or thickening of the horny layers of the palms and soles.

We have also been able to watch the action of the drug on the largest and most typical extra-genital chancre we have yet seen. The patient reported sick on February 28th, 1908, with a large, hard, ulcerating mass, the size of a walnut, on his lower lip; the surrounding tissue was considerably indurated and the mucous membrane of the lower lip ulcerated. At the left angle of the lower jaw there was a large, hard glandular mass. The patient stated that he had only had the condition for the last eight days. He said it was very painful, and he looked ill. Five days after admission there was a faint roseolar rash all over the body. The patient was given an injection of the sodium-amino-phenyl-arsonate on February 29th, viz., 9 grains, and this has been continued every other day. The chancre itself was dressed with an ointment made up of 12 grains of the drug to the ounce. At the time of writing the patient has had 45 grains of the drug by injection, the chancre itself is very much smaller and looks much cleaner, and the patient states he is free from pain. The glandular enlargement at the angle of the jaw has almost disappeared; the rash entirely vanished five days after its appearance.

When the "Atoxyl" treatment was first tried by us the question of what quantity of the drug should be injected, was rather a difficult one to decide, since we were working with quite a new drug; and, further, in view of the accidents reported from the Continent by other investigators, the necessity for proceeding with great caution was recognized. We began by injecting 6 grains every alternate day until the patient had had between 50 and 60 grains—that was about nine injections—the exact quantity depending upon the severity of the case and its progress. It was generally found that all symptoms had disappeared after eight to ten injections. After the patient had received this number of injections, they were stopped, and he was kept under observation in order to see what time elapsed before there was a recurrence of symptoms. In the majority of the cases a period of eight to ten weeks elapsed before the patient returned with any active signs of the disease, which were, however, very slight and easily yielded to a second course of injections of 6 grains each. But two men have been four months, and three men three months, since the last injection, without any sign of a recurrence of the disease so far. The two former men have only had 48 grains, and all have had very definite symptoms to start with, such as induration of the sore, maculo-papular eruptions on the trunk and arms, alopecia, and general adenitis.

When thirteen cases had been treated with eight to nine injections of 6 grains each without a single case showing signs of intolerance or toxicity, it was decided to increase the first two or three injections to 9 grains and then continue with 6 grains. In this way 80 to 90 grains were given during a course, and as no unfavourable symptom was noticed after this increased dose, it was decided to give 9 grains right through the course of eight to ten injections. All the patients who have had this treatment have done remarkably well, and no symptoms of intolerance have been noted.

It is too early to say how many courses of injections are necessary to completely stamp out the disease, or if it will be possible to increase the dose without causing toxic symptoms. There still remains a considerable amount of work to be done in connection with the treatment, but we feel satisfied that in this sodium-amino-phenyl-arsonate we have a very valuable agent in the treatment of syphilis. Its immediate action on the lesions of early syphilis would appear to be quite equal to, if not better than, that of mercury. It has many advantages over mercury, without any disadvantages. It is very easily injected, as it dissolves readily in hot distilled water. The injections are absolutely painless, there has not been one single complaint of pain or tenderness after an injection, or the least suspicion of induration or thickening. It is very portable, as the drug is made up by Messrs. Burroughs Wellcome and Co. in "Tabloids" of 1 grain each. Injection of the drug is never followed by salivation or spongy gums, which is such a frequent complication in the treatment with mercury; and lastly, it should be of especial value in India and tropical countries, where the patients, already debilitated by disease and climatic conditions, are unable to take mercury in any form, whereas the sodium-amino-phenyl-arsonate should have a tonic and alterative effect.

The injections are given intramuscularly in exactly the same way as mercurial injections. Care should be taken that the syringes used for injecting atoxyl be sterilised by heat, since acids (carbolic) decompose the drug. The manufacturers claim for this sodium-amino-phenyl-arsonate that it is not decomposed after boiling for five minutes.

In addition to this sodium-amino-phenyl-arsonate, we have also tried injections of a drug closely allied to arsenic, and which certain experiments pointed to as having a very powerful action in trypanosomiasis, viz., antimony, but the injections caused so much pain and local trouble that they had to be abandoned. Nevertheless, although the cases had only received two injections of 1 grain

each, the symptoms of syphilis, which had been marked and characteristic, disappeared, and at the moment of writing (two months since the last injection), there has not been any recurrence of the disease in the one case; while in the other, a small ulcer has just appeared inside the lower lip.

Just as this paper is going to press, Messrs. Burroughs Wellcome and Co. have issued two new allied substances, under the titles of:

"Kharsin" (sodium-3-methyl-4-amino-phenyl-arsonate).
"Asodyl" (sodium-3-methyl-4-acetyl-amino-phenyl-arsonate).

It will be noted that Kharsin differs from sodium-aminophenyl-arsonate in the presence of the methyl radicle and Asodyl contains contains in addition an acetyl radicle.

It is claimed for Kharsin that it is anhydrous, contains 25·4 per cent. of arsenic, and is soluble one in one of water, giving a neutral solution. Asodyl contains 24·8 per cent. of arsenic, and is also soluble one in one of water. Kharsin is similar in toxicity to sodium-amino-phenyl-arsonate; while Asodyl is one-fifth to one-sixth less toxic than sodium-amino-phenyl-arsonate. Both of these preparations are now being used in hospital; and the cases, though only a few injections have been administered, are doing remarkably well.

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By Lieutenant-Colonel W. B. LEISHMAN.
Royal Army Medical Corps.

(*Continued from p.* 256.)

The Ætiology of Syphilis.

Hoffmann (Berlin), the joint discoverer with Schaudinn of the *Treponema pallidum*, commenced by describing the various situations of the body in which the spirochetes had been found, and their association with the early and late lesions of syphilis. For demonstration of the spirochete he said that Giemsa's stain was best for fresh films and Levaditi's silver method for sections; but he pointed out that it was also possible to stain the parasite in sections by Giemsa's stain, and to demonstrate them in films by the silver method, if proper precautions as to technique were followed. For diagnosis, he thought the best method was staining by Giemsa combined with a search for the unstained spirochetes with dark-ground illumination. The spirochetes are found chiefly in the connective tissue, in the lymphatic vessels, and in the walls of the blood-vessels; occasionally they are to be met with in leucocytes, hepatic cells, and other tissue cells. The conditions found in the blood are not, apparently, favourable to the development of the spirochete, possibly because it is an anaerobe. He then went on to describe the well-known morphological details of the parasite, and the manner in which it could be differentiated from others. He adhered to the views of those who consider that the spirochete multiplies by longitudinal division in the same manner as the trypanosomata. So far, no successful method of cultivation has been ascertained. He concluded by pronouncing categorically in favour of the spirochete as the cause of the disease, and said that it held the same diagnostic importance for syphilis as the *Bacillus tuberculosis* for tubercle.

Zabolotny (St. Petersburg) recorded the results of his search for the spirochete in syphilitic material, and said that it could be detected in the great majority of cases of primary and secondary nature. He also laid stress on the fact that the spirochetes were agglutinated by the addition of serum derived from syphilitic patients, and regarded this as strong corroborative evidence of the

causative *rôle* of the parasite. He had no doubt in his own mind as to the ætiological significance of *pallida*.

Metschnikoff, who followed, dealt with the question of the prophylaxis of syphilis, and his pronouncement on this important matter had been greatly looked forward to by the members of the Congress. The researches which he detailed had been carried out by himself, in collaboration with Roux and Salmon, and had been directed towards the prevention of the disease by intervention between the period of exposure to infection and the development of the primary lesion. He recalled his earlier attempts in this direction with serums and with vaccines, freed from the living virus; these had failed, and his recent work had been in connection with the use of an ointment containing a mercurial base, which could be applied within a short period of infection. His initial work with these ointments has already been published, and he confined himself to describing the preparation which had given him the best experimental results on monkeys and which appeared to be best adapted for use in man. He insisted on the necessity for the employment of the mercurial salt in sufficient concentration, and gave the formula of the ointment which he now used:

Calomel	33 grammes.
Pure lanoline	67 ,,
Vaseline	10 ,,

The vaseline had been added recently, as it was reported that the large proportion of lanoline prevented the ready absorption of the ointment, and, in addition, rendered it too thick in cold weather. He had experimented with many other diluents, but found that vaseline was the only one which could be relied upon not to lessen the protective power of the ointment. An attempt to utilise an ointment with a basis of silver nitrate, with a view to the simultaneous prevention of syphilis and gonorrhœa, had not succeeded. Going on next to deal with certain failures which had been reported by Neisser and others in connection with the prophylactic use of this ointment, he pointed out that what had been used in these cases contained too low a proportion of calomel, and such failures quite bore out his monkey-experiments as to the necessity for the employment of this salt in the strength given above. Similar apparent failures had been reported to him personally by certain sufferers in Paris, who complained that they had contracted the disease in spite of the employment of the ointment; in all these cases he found on enquiry that the ointment had been procured from chemists, under various names, and that none of them contained

the calomel in the proportion which he had found to be necessary. If applied within a few hours of exposure to the risk of infection, he considered the above ointment an absolute safeguard, but, as it is certainly useless at a later period, he had continued his researches in the hope of finding some preventive treatment which would be successful when applied some days after exposure. To this end he experimented with atoxyl, which Uhlenhuth had shown to be of use in the case of spirillar diseases of animals, and which Salmon had used with success in the treatment of syphilis. Working independently, Uhlenhuth, Hoffmann, and Roscher had experimented with atoxyl in the case of monkeys infected with syphilitic material; they had reported a fair measure of success, but their results were not sufficiently convincing, as a certain number of their control animals failed to contract the disease. He then went on to describe in detail his own experiments with monkeys. In the first series, he had given a succession of doses of atoxyl subcutaneously, at intervals of a few days, and succeeded in warding off the disease. Next, he tried the effect of giving a single dose only, in two cases as long as fifteen days after inoculation with the syphilitic virus, and again with a successful result. Control monkeys infected with the same material developed a sore after the usual incubation period. The minimum dose which he had found efficacious was 33 milligrammes of atoxyl per kilogramme weight of the monkey. In another series he tested the duration of the preventive effect, reinoculating two monkeys, which had previously been successfully treated prophylactically, on the seventy-seventh and ninety-first day respectively, after they had received the first inoculation of syphilitic virus. Both of them developed the characteristic lesion. He concluded from this that the immunity conferred by the atoxyl is not of long duration, and, further, that the treatment does not lead to any generalisation of the virus in the system. Recognising that the simpler the method the greater the likelihood of its being adopted by the public, he attempted to give atoxyl by the mouth; but the results had not been satisfactory, and he relied still upon subcutaneous inoculation. Passing, then, to the question of the toxicity of atoxyl, and the dangers which had been reported in connection with its use, especially in connection with damage to the vision, he said that, calculating from the appropriate dosage for monkeys, the dose which would be necessary for a man of 60 kilogrammes would be 2 grammes. Good results, however, in the way of treatment had been obtained by the use of much smaller amounts than this, and he quoted the experience of

Hallopeau, who was in the habit of giving three successive doses, of 75, 60, and 50 centigrammes respectively—a total of 185 centigrammes—without any bad effects. He then mentioned two instances in which he had given two doses of 50 centigrammes of atoxyl subcutaneously, at an interval of two days, to men who had placed themselves in danger of contracting the disease; neither suffered from any bad effects of the drug, and neither contracted syphilis. He did not, however, attach any importance to the latter fact as evidence of the prophylactic potency of the drug, as neither case was certainly infected. He is at present experimenting in the hope of finding some form of arsenic which will be efficacious without possessing the toxicity of atoxyl. For the present, he said, the early use of the calomel ointment must hold the first place in the prophylaxis of the disease. The experiments which had been done with both methods had shown that the spirochete could only adapt itself to its new host by degrees, a fact borne out by the length of the incubation period, and he had failed to find any spirochetes at the site of experimental foci of infection in monkeys until fifteen days after inoculation, even when search was made in the serous fluid drawn from the spot with the help of Reichert's ultra-condenser—the best method of detecting *S. pallida* when present in a fluid in very small numbers. This period of latency, during which little or no multiplication of the spirochetes is going on, accounts for the success which has attended these efforts to apply prophylactic measures subsequent to inoculation of the virus. Greater difficulty was to be encountered in the attempt to impress on the public the necessity and efficacy of such measures, and M. Metschnikoff concluded by declaring that the progress of rational hygiene imposed upon medical men the duty of indicating to the healthy the means by which they could preserve their health, and this was in no case more important than when the diseases in question were venereal.

Bertarelli (Turin) followed, but covered much the same ground as Hoffmann. He, too, believed that the *Spirochæta pallida* was the cause of syphilis, although final proof could not be obtained until the organism had been successfully cultivated.

Landsteiner (Vienna) spoke chiefly on the nature of the serum reaction in syphilis, and the production of specific anti-bodies in the course of the disease. He thought that the power of resistance which is developed in the blood after infection is not absolute, and that at times the introduction of fresh virus might produce certain symptoms pointing to a re-infection. On the same principle a

patient suffering from tertiary syphilis might, if re-infected with fresh virus, show fresh symptoms of a tertiary type.

In the discussion which followed the reading of these five papers many members took part. Siegel once more recorded his views on the non-specificity of the spirochete of Schaudinn and Hoffmann, and described afresh the *Cytorrhyctes luis*, which, in his opinion, is the true cause of the disease. Citron, Fornet, Wassermann and others spoke on the value of the serum diagnosis of syphilis, and the results which had been obtained by the application of this test in the so-called para-syphilitic affections, such as tabes dorsalis and general paralysis. Saling brought forward the results of his further investigations into the nature of what he has termed the "silver spirochætes," demonstrated by Levaditi's method of staining, and mentioned the various non-syphilitic conditions in man and in animals, in which he had found, with this method of staining, spiral threads indistinguishable from the *S. pallida*.

With the exception of Siegel and Saling, there was a remarkable uniformity among the speakers as to the causative *rôle* of the *Treponema* (*vel Spirochæta*) *pallidum*, and it was obvious that nearly all of those whose views were placed on record at the meeting held it to be the *causa causans* of the disease, although the final proof cannot be made until the spirochete is obtained in pure culture, and experiments can be made with such cultures in accordance with the canons of Koch.

Pathogenic Spirochætæ.

Doflein (Munich) opened this discussion with a paper in which he dealt with the pathogenic spirochetes from the point of view of their morphology and conditions of growth and development. He said that the staining methods at our command were insufficient for the purpose of demonstrating the finer details of their structure, and on this account he was not inclined to attribute much importance to what had been described as a blepharoplast, which he thought might be only a condensation of the protoplasm and not a definite structure. As regards the vexed question of the method of multiplication, he thought that all spirochetes did not behave alike in this respect; in the case of some he considered that longitudinal division had been proved, but in others transverse division appeared to be the rule. No definite evidence of sexual forms had been observed. As to the biological position of these organisms, he differed from those who considered them bacterial in nature, but thought that the evidence in favour of

their being protozoal was also inconclusive; on the whole he suggested that they might occupy a position midway between the animal and the vegetable kingdoms, and considered that they should be placed in a separate class, for which he suggested the name of "Proflagellata."

Levaditi (Paris) commenced by giving a list of the pathogenic spirochetes, and pointed out that, with the exception of those of syphilis, yaws, and a dermatosis of the pig, all were the cause of true septicæmias, and were capable of multiplying freely in the blood-stream. Several of them were so closely allied that it was impossible to differentiate them by means of morphological details, but in several of these instances, noticeably in the case of the relapsing fevers of man, this differentiation had been made possible by means of biological tests. As to their supposed protozoal nature, he was of opinion that this had not been proved, and he doubted the accuracy of the observations which recorded the finding of such details of structure as an undulating membrane, nucleus, blepharoplast, &c. At the same time, he was careful not to commit himself on the other side and pronounce for their bacterial nature, although he evidently attached greater importance to the reported discovery of peritrichic flagella in the case of *Spirochæta gallinarum* and *S. duttoni* than others do. He referred next to his so-called "cultures" of spirochetes, obtained by keeping them alive in collodion sacs in the peritoneal cavities of rabbits. Under such conditions the spirochetes had kept their virulence and their vitality for a long time and through many passages. The infectivity of the spirochetes is, however, eventually lost, or at least greatly diminished, when they are kept under these conditions. Turning to the question of the mechanism of the relapses, which are so marked a feature of many of these diseases, he considered that the crisis was brought about by the phagocytosis of the spirochetes and their intra-cellular digestion, and not through the action of specific anti-bodies, which only make their appearance in the blood after the crisis is over. He pointed out that the spirilla did not, however, disappear entirely from the blood during the interval, but that a few could always be found on careful search; and he went on to discuss the questions raised by this observation in connection with the proved presence of specific anti-bodies and the subsequent development of the relapse in spite of this. He thought that the explanation was that such spirochetes as had escaped destruction during the crisis had become immune to the action of the anti-bodies, and in this way were able to multiply and produce a

second attack. He had found that such immune spirilla were able to transmit their powers of resistance to their progeny, because relapse-spirochetes were found to preserve their resistance after several passages through susceptible animals. After detailing the known facts as to the passage of certain spirochetes through the bodies of ticks, and their transmission to the young of these ticks by infection of the ova, he went on to the subject of vaccination; this, he said, was very easy to produce in animals by the injection of killed spirochetes or of a non-lethal dose of living organisms. Preventive serum-therapy was also possible, because the serum of animals which had recovered was found to be strongly bactericidal and agglutinative. He concluded by some remarks on the treatment of certain spirilloses, mentioning that atoxyl had been found to prevent and to cure the spirillosis of fowls, and that benzidine had proved of service in experimental tick fever.

Inoculation against Typhoid Fever in the Army.

Musehold (Generaloberarzt, Berlin) commenced his paper on this subject by detailing the history of the anti-typhoid inoculations in the German Army. The vaccine which has been employed for this purpose was that of Pfeiffer and Kolle, and it has been used in the case of troops engaged in the operations in German South-West Africa since 1904. As in England, inoculation is purely voluntary, and much the same measures had been employed in getting the men to volunteer for inoculation, namely, lectures to the men given by special medical officers. The system of dosage and the method of preparation of the vaccine have already been published in full and need not be repeated here. On the whole, the results have been very encouraging, although not so good as those obtained in the British Army by Wright's method. He was inclined to attach considerable importance to the occurrence of the negative phase, which, he said, considerably reduced the sphere of usefulness of the method, since one could inoculate neither immediately before active service nor shortly before arrival of troops in a country in which enteric fever is endemic. He spoke at length on the subject of the collection of statistics relating to inoculation, and showed a number of tables giving the latest results obtained in Africa. Apparently, however, our *confrères* have found the same difficulty in collecting satisfactory statistical information on this subject as we have. He thought that any modification of the vaccine which would lead to a diminution in the immediate toxic effects,

would be a great gain, and would do much to popularise the system. The occasional severity of the reactions in the case of Pfeiffer and Kolle's vaccine, necessitated special attention being given to the inoculated, and their absence from duty for some days. He suggested that a single inoculation with an improved vaccine, which could be relied on to give an immunity of a few months duration, would be an advantage, and he thought that the combination of some anti-typhoid serum with a vaccine which contained no bacterial bodies might perhaps furnish such a vaccine. He concluded by saying that there was little prospect of inoculation becoming compulsory in the army until a better vaccine could be provided.

Leishman next described the progress and the results of typhoid inoculation in the British Army, showing tables giving the most recent statistical information (these have either been published or will shortly be published in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, and need not be repeated). He did not agree with the former speaker as to the dangers of the negative phase, as he has received no satisfactory evidence of any increased liability to infection following inoculation, and had failed to find any evidence of it in measuring the amount of protective substances appearing in the blood after inoculation. He concluded by urging the advisability of compulsory inoculation of all men liable for foreign service, or for active service with the colours in time of war, as the ideal to to be aimed at, but feared that the time for this had hardly yet arrived.

A long discussion followed the reading of these two papers. Sir A. E. Wright spoke chiefly on the blood changes which follow inoculation by his method, and the importance of measuring accurately the strength of the vaccine. The method employed in the case of Pfeiffer's vaccine was, in his opinion, crude, depending as it did upon "loopfuls" of a typhoid culture instead of upon an enumeration of the actual number of germs. Pfeiffer, Brieger, Bail, Kolle, Kuhn, Wassermann and Lion continued the discussion, which was confined almost altogether to the exact nature of the immunising process, and the mechanism of active immunity in general, and had little to do with the special application of inoculation to the needs of an army. There was a general agreement as to the protection resulting from inoculation, whether by Wright's, Pfeiffer's, or other methods; indeed, this side of the subject appeared to be taken for granted by all who spoke, and the only reference to the military side was in the case of the last speaker, who had served

in South-West Africa, and was of opinion that there was some evidence of an increased liability to enteric among those who had been recently inoculated with Pfeiffer's vaccine.

Ships Infested with Plague Rats.

The discussion and papers on this subject were combined with others which were to have been dealt with in Section V. under the head of "Spread and Prevention of Plague." For this purpose there was a joint meeting of the two Sections, of which the following is a brief account:—

Gaffky (Berlin) commenced by describing the part played by rats in carrying the disease from port to port in ships, and also in keeping alive a nidus of infection in a locality. He granted that the germs were carried from rat to rat by means of insects, such as the flea, but did not think the actual manner in which it was conveyed from rat to man had been definitely established. The infective nature of pneumonic plague was pointed out, and also the danger of indirect transmission of infection by means of infected linen and clothing; this indirect transmission, however, becomes of less danger if the infective material is dried. Turning to defensive measures, he thought that there was no certain method, but that the adoption of the rules laid down at the International Sanitary Conference in Paris, in 1903, should form the basis of any organised scheme. Rats should be destroyed as much as possible, especially in ports and on board ships, and, in the event of any exceptional mortality occurring among the rats, the corpses ought to be examined bacteriologically. He advocated the compulsory notification not only of actual cases but also of those which were suspected, and the isolation of all cases of the disease. Healthy persons who have been exposed to infection ought to be kept under medical supervision for ten days, if not actually isolated. Disinfection, and, if necessary, evacuation of infected buildings, should be carried out, and he thought that protective inoculation with plague vaccine helped to lessen the incidence of the disease.

Kitasato, who was absent, had his paper read for him by Kutscher, but I did not hear this, and was unable to obtain details. He was followed by Ashburton Thompson (Sydney), who described the researches which had been made in connection with plague in Australia, and attributed to the rat flea the principal part in the transmission of the disease from rat to rat and from rat to man.

Kossel (Giessen) then spoke on the question of ships infected with plague rats. In his opinion it was through such rats that the disease was transmitted to other ports and countries, and he did not consider that goods from ships infected with plague rats were in themselves dangerous as bearers of contagion as long as they did not carry with them infected rats, living or dead, or other living intermediaries such as fleas.

Giemsa (Hamburg) followed with an interesting paper on the same subject. He said that it was absolutely necessary that all ships which had anchored at plague-infected ports, or had taken cargo from them, should have all the rats destroyed by some sure means, so that none should be free to get ashore at a new port and infect the rats of that port. This has, so far, been made obligatory only for ships which have on board either cases of plague in man or plague-infected rats. Captains of ships must give early notice to the medical authorities of the port when any dead rats are found on beginning to discharge cargo, and such rats must be placed in special metal cages and sent to the plague laboratory for examination. If rat plague is detected, then all the rats must be killed by some suitable means, and the ship must at once be towed to a safe distance from the wharf, so that no rats can get ashore. He then went on to describe the apparatus which had been devised by Nocht and himself for the purpose of generating and distributing a poisonous gas in the holds of ships. (A model and sketches of this apparatus in action were shown in the Exhibition of the Congress.) As to the gas to be used, he discussed the disadvantages attaching to those which had been recently recommended. Liquid carbonic acid gas, for instance, is of too high specific gravity and does not mix well with the atmospheric air, and the quantity required to kill the rats—50 per cent. of the cubic capacity of the ship—would be much too expensive; its killing effects also are uncertain. Sulphurous acid, on the other hand, as employed in the Clayton process, and, combined with other gases, in other methods, is readily absorbed by certain materials, such as wool, grain, salted skins, &c., and especially by the bilge-water, and is thus so reduced in strength that its rat-killing and insecticide powers are unreliable; it also damages many kinds of goods, and has the further disability that, to be effective, several days must be allowed for its action. While granting that the ideal gas had not yet been discovered, he thought that the one which they recommended, and which was now in use at Hamburg, presented several advantages over those mentioned. Its composition he gave as the following:—

Carbonic oxide ..	..	5 per cent.
Carbonic acid ..	..	18 ,,
Nitrogen ..	.. ..	77 ,,

and the advantages which he claimed for it were these: (1) It is almost devoid of smell and of chemical activity, and is thus little likely to damage the cargo; (2) it is very deadly in its action, and is absolutely certain to kill all the rats; (3) it is relatively cheap, and can easily be produced in very large quantities, so that even large ships can be filled with the gas in a few hours. After the application of this gas the cargo may be unloaded, but, as it has no disinfecting action, the rubbish and sweepings left on board must be collected and burnt, and the ship itself may then be disinfected with one of the usual agents, such as formalin, cresol, lime-wash, &c.

Bitter (Cairo) then spoke on the occurrence of plague in Egypt, and said that when it had appeared there the pneumonic form was very common. The sanitary control of the country, however, had kept it freer from plague than India. Borel (Havre) said that in France it was compulsory for all ships coming from plague-infected ports to be cleared of their rats by the action of sulphurous acid vapour, and he knew of no accidents or damage in connection with its use. Tjaden (Bremen) did not agree with Giemsa's conclusions, and spoke of some fatal accidents which had occurred through the introduction of a poisonous gas into the holds of ships; the failure of Giemsa's gas to kill fleas was also a grave defect, and he thought that a sulphur method might in many cases, where the nature of the cargo permitted, be a better process. Giemsa, in replying, said that the fatal accidents to which Tjaden had referred were not attributable to any fault of the method, but had been caused by the neglect of proper precautions by the workmen.

Preventive Inoculation against Typhoid, Cholera and Plague.

Pfeiffer (Königsberg) read the first paper on this subject, commencing by describing the general line which should be followed in the preparation of vaccines against these three diseases. In the cases of cholera and plague it was desirable to select strains of the highest virulence, but in the case of typhoid fever the criterion should be the antigenetic property of the strain, which may be tested for by employing the smallest possible doses in animals. He did not think that the binding affinity for the specific amboceptors, as advocated by Wassermann, was a sufficient test in the

case of the typhoid bacillus. The vaccine of Pfeiffer and Kolle he thought the best in all cases, and he quoted the favourable results which had been obtained by the use of their vaccine in the case of the German troops in South-West Africa. The vaccine is an agar culture of the germ, grown for twenty-four hours, and sterilised by heat at 60° C.; it is easy to prepare and readily standardised. Similar good results had been obtained in the case of plague and cholera vaccines prepared on the same lines. Haffkine's and Wright's methods he considered as being only slight modifications of his own, and he thought their disadvantages lay in the complicated methods necessary for the determination of the strength. He then went on to describe and criticise other well-known methods of vaccination. Loeffler's sterilisation of cultures by drying at a temperature of 120° to 150° C. he thought worthy of further trial. The methods of Shiga, Neisser, Wassermann, Brieger, Meyer and Bassenge, all depended upon the extraction of the soluble substances from the bodies of the bacteria by various means, such as autolysis, extraction in distilled water or salt solution, &c.; and were, he considered, wrong in principle, as it is impossible to separate the immunising substances from the toxic elements in the bacterial cell, and, further, there is evidence that it is desirable to make use of all the antigenetic substances present. The method of Besredka, while correctly founded from the point of view of theory, had great technical difficulties in its preparation, and, in addition, it was difficult to get rid of the excess of serum which, if left, reduced the immunising efficiency of the vaccine. The employment of attenuated living cultures, as prepared by Kolle and by Strong, was, he thought, open to grave objections. The vaccines should be injected subcutaneously, and the intravenous injections of Friedberger and Moreschi had shown that the greatest care was necessary as regards dosage and preparation if serious toxic accidents were to be avoided. Feeding experiments with cholera and plague, in an attempt to secure the local immunisation of the intestine, had not been tested sufficiently. He advocated repetition of the dose, as this increases and prolongs the immunity. As to the best means of ascertaining the effects of a vaccine, he thought his own method of measuring the quantity of the specific bacteriolysins in the bodies of animals was far preferable to experiments conducted *in vitro,* and also to the method of Wassermann and Kolle for estimating the deviation of the complement. He concluded by saying that he thought the dangers of the so-called "negative phase," in the sense of Wright, had been much exagger-

ated, and it was doubtful whether such a phase existed at all. He also thought that the system of measuring the opsonic index was not founded upon a sufficient theoretical basis.

Strong (Manila) described his experiments in connection with the use of plague and cholera vaccines, prepared in many different ways, and tested upon animals, both as to the amount of protective substances in their blood and as to the degree of protection against infection. On man he had had experience of 6,000 inoculations done with a cholera vaccine, prepared by Wassermann's method, and had found that it gave good results; a high titre of free receptors was, however, needed to produce a strong immunity. In his experiments on plague vaccines he had tried many methods, including artificial and natural aggressine immunisation and the use of living cultures of low virulence; the last method, true "vaccination," had given the best results, and he strongly advocated the use of such a vaccine in man for the prophylaxis of plague. In testing the effects of immunisation on animals, the only tests which could be relied on in the case of plague were the determination of the opsonic index by the method of Wright and the fixation of the complement by Bordet's method; no agglutinins or bactericidal substances could be measured. He had had the opportunity of testing this method of vaccination in man, and had found the mortality among the inoculated was 16·6 per cent. as against 66·6 per cent. among the un-inoculated. In conclusion, Strong recommended the appointment of an international commission to determine the best methods of inoculation.

Sir A. E. Wright spoke on the effects of inoculation of bacterial vaccines in local diseases in which no immunisation process was manifest if looked for during the stage of remission. Speaking of opsonins and their nature, he said that the opsonin was an expression of the immunity, but it was questionable whether it actually produced it. In processes of immunisation it was not sufficient to increase the quantity of bacteriotropic substances, but one must also attempt to bring these substances in actual contact with the infecting bacteria.

Lucksch (Czernowitz) spoke on the immunisation against dysentery by means of vaccine, and had found good to result only when the bacillus employed was that of Flexner.

Zabolotny (St. Petersburg) gave the results of his experience of cholera inoculations. Among 12,000 non-inoculated there were 553 cases and 311 deaths, while among 5,887 inoculated there were only six cases and three deaths.

NOTES ON THE EXHIBITION IN CONNECTION WITH THE CONGRESS.

(1) Models and photographs were shown of the apparatus devised by Nocht and Giemsa for the destruction of rats in ships suspected of carrying plague. The system is somewhat similar to that of Clayton, but the gas evolved by the machine is different and the authors claim for it a more effective action. The details were fully described in a paper read at one of the Section meetings (see Summary in Report).

(2) A very excellent series of anatomical preparations was exhibited of the organs of experimental animals, such as guinea-pigs, rats, rabbits, &c., after infection with various bacterial diseases, principally tubercle and plague. The dissections of plague rats were particularly instructive, and very clearly demonstrated the characteristic lesions.

(3) A collection of the principal ticks which are concerned in the spread of diseases in man or animals was shown, each species being illustrated by specimens of the eggs, larvæ, nymphs, and adults of both sexes. Some large wall diagrams were also displayed, showing the chief external features of the principal genera of ticks.

(4) A series of test-tube experiments, illustrating the application of the precipitin test for blood and other animal matters in medico-legal work, was exhibited, showing very clearly the great value of such biological tests. One of the series illustrated a practical application of the test for the purpose of differentiating the different kinds of meat-albumin, the experiment being carried out with material derived from a sausage suspected to have been made of horseflesh; the positive reaction demonstrated clearly that this adulteration had been practised. The application of the tests was much simplified by the neat form of the apparatus which had been devised for the purpose.

(5) A series of microscopical preparations demonstrating the action of the addition of immune serum in stimulating the phagocytosis of bacteria, was hardly so good, the leucocytes shown in the specimens being agglutinated and masked by the large number of bacteria used in the experiment. The ordinary technique employed in opsonic work would have given more convincing results.

(6) A number of large coloured wall plates were shown, illustrating much of the work of the late Dr. Schaudinn. Most of them were copies of figures and diagrams with which workers in protozoology are familiar, but they formed a very interesting memento of the man who has left behind him such a wealth of brilliant work in many fields.

(7) A large number of permanent plate cultures of the various pathogenic micro-organisms was shown, and, in particular, many illustrating the differential diagnosis of closely allied organisms by means of special media. For example, typhoid colonies were shown growing on the surface of Loeffler's malachite green agar and contrasted with colonies of the paratyphoid bacilli, *Bacillus coli* and others. Many of these specimens were of extreme interest, and all showed the special points of distinction with great clearness. In connection with this branch of the exhibits it was to be regretted that the various specimens shown by the different institutes and laboratories, whatever their nature, were arranged in separate groups for each laboratory. Had the specimens illustrating a particular disease or subject been grouped together, regardless of the source from which they had been received, one would have been able to get a better impression of the richness of the material in this section. As it was, exhibits dealing with the same subjects were to be found widely scattered through the various rooms, and naturally this occasioned much overlapping and repetition. It is true that the various exhibitors were competing for certain prizes and obviously wished to make an impressive display of their particular specimens, but it should not have been beyond the powers of the organising committee to have arranged the exhibits of like nature in a manner which would have been much more instructive to the observer and yet have done no injustice to the competing institutions.

The series of bacteriological exhibits sent by the Institute for Infectious Diseases, Berlin, was particularly good, and illustrated most of the recent advances in bacteriology. Among them were a number of coloured plates of the various animal transmitters of disease, including glossinæ, mosquitoes, ticks and fleas. The cases of biting flies and insects were, however, disappointing, in view of the fact of the great and increasing importance of their recognition in the prevention of many fatal diseases. A really good collection of type species would have added greatly to the value of this Section.

(8) A large amount of apparatus was shown by this Institute, and this department cannot be too highly praised. The finish and general workmanship appeared as good as it is possible to obtain, and great ingenuity was displayed in many of the special pieces of bacteriological equipment. Portable laboratories for special purposes were a feature of this and one or two other exhibits, and nothing could be more complete than many of these compact and

serviceable collections. I was not, however, able to ascertain whether any of them had been submitted to prolonged tests in actual service conditions, and some of them looked to me *too* compact and compressed in the packing to stand the rough wear to which they would inevitably be subjected when in actual use. The most serviceable of these was the portable bacteriological laboratory for field service, shown by the Ministry of War. (A note of its contents, &c., will be found attached to the report of Lieutenant Colonel Macpherson.) The boxes in which this outfit was packed looked as if they were really intended to stand rough transport, and altogether the various parts of the necessary apparatus appeared of stouter build and of greater durability.

(9) *The Spirochæta pallida.*—Many laboratories sent specimens, microscopical slides, plates, photographs, &c., of this much-discussed organism, and, once more, it was a thousand pities that they were not collected together and methodically arranged, especially as so much of the value of such specimens lies in being able to contrast them with others derived from similar or from different sources. Had this been done the series would have been unique, for many of the isolated exhibits, in themselves, were of great beauty. One of the most interesting of this series was a demonstration of the living spirochete by dark-ground illumination. Fresh material containing the parasites was taken daily from a case in one of the Berlin hospitals and exhibited for a few hours. The delicate little parasites were easily recognisable and identified by means of the close twisting of the spirals. The movements were quite easily seen, although, in the specimens which I saw, rather sluggish; they consisted of a slow rotation of the spirochete on its long axis, with an alternate bending and straightening of the rod. They showed no sign of the intense energy of some of the other spirochetes, such as those of relapsing fever and tick fever. There were also many specimens showing the spirochetes stained in films by Giemsa's method, or in sections by Levaditi's method of silver impregnation, some of which were extremely beautiful. Innumerable photo-micrographs and sketches were also exhibited, illustrating various points as to the distribution of the spirochetes in the tissues in the various lesions of syphilis in man and in experimental animals. In connection with this subject a very interesting series of microscopical specimens was shown by Siegel, demonstrating the so-called "silver spirochetes" which had been found in various animal tissues, and in the human body, in cases in which there could be no suspicion of syphilis.

Some of these specimens showed black spiral threads which might easily have been taken for the *S. pallida*, but it was suggested that these were not spirochetes at all, but only delicate nerve fibrils or filaments of connective tissue which had been coloured by Levaditi's method. It must, however, be remembered that, even if these threads were spirochetes, our knowledge of these organisms is as yet very slight, and it is quite possible that there may be one or more which are parasitic in the lower animals and resemble *S. pallida* as closely as the *Bacillus coli* resembles the typhoid bacillus. Siegel also showed some specimens of the *Cytorrhyctes luis*, the organism which, in his opinion, is the cause of syphilis.

In connection with this subject several specimens were shown of the lesions produced in monkeys by experimental syphilis, and many beautiful coloured sketches of the same subject were hung on the walls. Altogether, the exhibits illustrating the recent great advances in connection with our knowledge of the causation of syphilis were exceptionally complete and of the greatest interest.

Many specimens of other spirochetes were also to be seen under the microscope, and, in particular, some showing the so-called flagella of the spirochete of tick fever were of personal interest to me, as I had searched for them myself in vain. The slides shown, however, did not convince me as to the reality of the existence of this structure, and the photo-micrographs of the same specimens were more suggestive than the specimens themselves.

(10) Mention should be made of the large number of wax models, coloured to life, which were made use of in many of the exhibits to illustrate various diseases. These were most beautifully executed and extremely life-like. They were, for instance, used to show certain lesions of the skin and other tissues in the case of tubercular and syphilitic disease, and to demonstrate the effects produced by certain industrial diseases, such as lead-poisoning. The majority appeared to have been prepared by the Pathoplastic Institute of Berlin, and they were certainly the best things of their kind which I have seen.

(11) Photo-micrographs were very largely used to illustrate many of the exhibits, and most of these showed what excellent results may now be got, even with the very highest magnifications, by the use of modern instruments. Several series of large prints, 6 inches to 8 inches in diameter, showed most graphically certain groups of micro-organisms and of protozoa, and were of high value for comparative purposes.

(12) Many of the large laboratories and institutes of Germany sent very complete collections of anti-sera and of vaccines for every imaginable disease; but, except as an indication of the lines of activity of the particular institute, such specimens are not of great interest from the spectacular point of view. At the same time it was interesting to come across three or four different typhoid vaccines among such collections, though few of them had been used on any large scale with the exception of Pfeiffer and Kolle's, which is employed in the German Army. In connection with this branch of preventive medicine many ingenious pieces of apparatus were shown, whose purpose was to simplify the technique of the preparation of serums and vaccines, and to render the various operations safer from the point of view of sterility. It may also be noted with gratitude that, although mercantile firms were represented in this department and in many others, no attempt was made to thrust pamphlets and samples into the hands of the members; and, although information was forthcoming on the slightest encouragement, none was volunteered unless it was asked for. This may seem a small thing, but it added very much to the comfort of those who wished to study the exhibits. The Executive of the Exhibition were much to be congratulated on having had the forethought to provide against this all too common nuisance.

(13) Great attention has been paid by many of the laboratories to demonstrations of the various protozoa which are the cause of disease in man and in animals. Allusion has already been made to some of these, and there were many beautiful coloured drawings and photographs showing details of the structure and evolution of the malaria parasite, innumerable trypanosomata, piroplasmata, &c. A revolving stand in one of the main halls held a most interesting collection of these coloured drawings, illustrating many points which have been brought out by recent research, such as the life-cycle of parasitic amœbæ, the cultivation forms of trypanosomes, and the cycles of development of some of the rarer parasites of the blood in the lower animals. The writer recognised among them some of his original sketches of the cultivation forms of the kala-azar parasite which had already done duty in the Corps Journal. One of the most interesting of these sketches was shown in the exhibit of the Board of Health of Brazil, from Rio de Janeiro, which institute, by the way, took the gold medal awarded by the Kaiserin. In this, the cycle of development of the *halteridium* of the pigeon was shown, and also the forms met with in the fly which is the transmitter of this parasite, the *Lychnia brunea* (Oliv.).

The development of merozoites which goes on in the leucocytes of the pigeon's blood, takes place on a scale which is truly colossal, and results in the formation of an enormous mass of small parasites which has no parallel in similar protozoa, as far as I am aware. The fertilisation of the macrogamete takes place in the fly. It would have added greatly to the interest of this series of pictures if some of the actual films had been displayed; but, if any were shown, I was unable to find them.

(14) A series of culture plates was shown by one institute illustrating the effect of the application of "pyocyanase" in inhibiting the growth of the diphtheria bacillus. Needless to say, the plates proved its efficacy to demonstration; but, apart from this, very good clinical results are claimed for the agent when applied as a routine treatment in the disease. Pyocyanase is the ferment or enzyme which can be extracted from mass cultures of the *B. pyocyaneus*, and it has been proved to possess powerful bactericidal and bacteriolytic properties, while its use in diphtheria in the form of a spray has been said to give very good results, either alone or in combination with diphtheria antitoxin. Emmerich and Low, Escherich and others, have written on the subject and have spoken highly of its efficacy.

Needless to say, by far the larger part of the Exhibition was concerned with other lines of preventive medicine, such as the hygiene of schools and hospitals, water supplies, ventilation, drainage, &c.; but I have confined these brief notes to the more strictly bacteriological side, and have left the account of the rest of the exhibits in the more competent hands of my colleague.

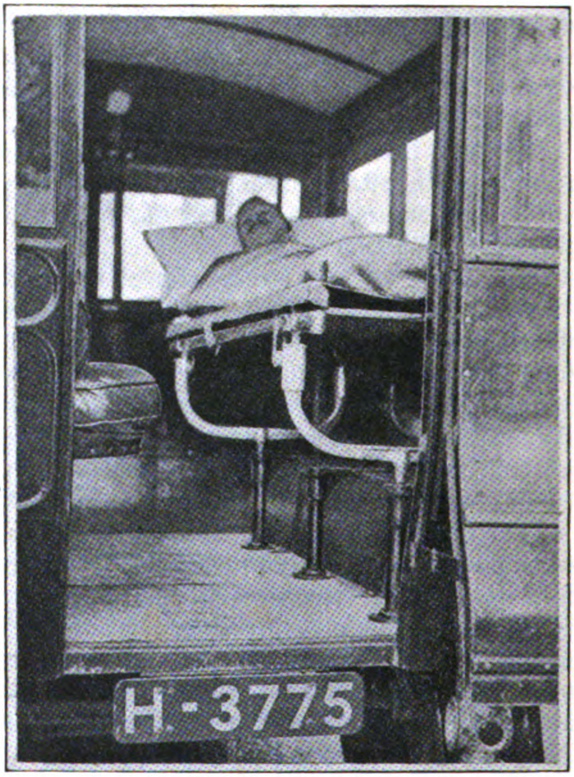
I cannot conclude this report without putting on record the cordiality of our welcome, as delegates of the War Office, by the Executive of the Congress, and, indeed, by all of those with whom we came in contact. No trouble appeared to be too great, for our hosts to show us anything which we wished to see, or to explain things which were difficult of comprehension to the "outlander"; and, in especial, our *confrères* of the German Army Medical Department were kindness and hospitality personified. If I were to summarise my impressions of the Congress, I should say that the two things which stand out most clearly in my memory are, first, the great interest of meeting in the flesh so many of the great ones of the bacteriological world—Ehrlich, Pfeiffer, Wassermann, Kolle, Loeffler, Mesnil, Metschnikoff, to mention only a few; and, secondly, the great pleasure of becoming acquainted to some small extent with the magnificent Corps which has the health of the German Army in its keeping.

Clinical and other Notes.

A NEW PNEUMATIC STRETCHER-CARRIER FOR MOTORS AND OTHER VEHICLES, AS FITTED TO THE OSBORNE CAR.

By Surgeon-Lieutenant-Colonel C. R. KILKELLY, C.M.G., M.V.O. (R.P.).
Governor, Osborne Convalescent Home.
Late Grenadier Guards.

I send you a print illustrating the interior of the Osborne motor-car. It will be noticed that there are three hollow standards which are fixed to the floor of the car; these are intended to take either chairs or the



patent stretcher-carrier. Inside these standards is placed a spring. The stretcher-carrier is made of a U-shape, with a plunger at the bottom which fits into the standard. On the top of the U are two more cylinders, into which fit two more plungers with U-shaped carriers, which

take the stretcher. These plungers work either on pneumatic cushions or on springs, and support the stretcher poles.

The stretcher-carriers are of a uniform pattern. The standards used for these carriers are also used for supporting the revolving chairs inside the motor. These chairs and carriers are interchangeable, and can be removed instantaneously as required. They are very light and strong, being made of aluminium, and have proved a great success as fitted to the Osborne car.

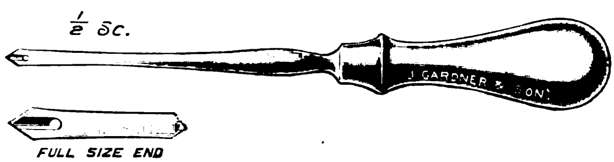
These carriers can be adapted for use in vehicles of many kinds, such as country carts, railway waggons, transport vessels, &c., by small modifications in the design of the carriers and standards.

I shall be happy to send further particulars to any officer who is interested.

A NEW BRADAWL FOR WIRING BONES.

By Lieutenant-Colonel W. DICK.
Royal Army Medical Corps.

I have always had difficulty in wiring the bones in compound or un-united fractures. The bones having been drilled or bored, there is comparatively little difficulty in getting the wire through one fragment, viz., that from the periosteal surface to the fractured surface; but there is considerable difficulty with the other fragment in passing the wire from the fractured surface to the periosteal surface. I found that this might be obviated by having the ordinary bradawl, with a hole about half an inch from the point, made with a groove leading from the hole to the point, as shown in the accompanying illustration.



The bradawl having transfixed the bone, the end of the wire, already through one fragment, is threaded through the hole in the instrument, bent, and pressed with forceps into the groove—the bradawl is then withdrawn with the wire.

The instrument has been made for me by Messrs. Gardner and Son, of Edinburgh.

A PERSONAL EXPERIENCE OF SPINAL ANÆSTHESIA.

By T. H. S.

A slight prick in the small of the back, a sharp blow as the needle was driven home through the tissues, and a faint dragging pain as it felt its way into the spinal canal. That was all, and the entire process of anæsthetising, so dreaded by the patient, and so troublesome to the operator, was over. In two minutes a warm glow spread slowly up both limbs, quickly followed by a tingling sensation in the feet. In another half minute a heavy leaden feeling spread up both legs, and only the very slightest movement of the toes could be performed. The feeling of numbness gradually increased, with loss of sensation, and in three and a half minutes there was complete anæsthesia up to the umbilicus, and I was experiencing the curious condition that, with complete control of all my faculties, I was, for all practical purposes, dead from the waist downwards.

During the whole operation, which was in the region of the right hip and the muscles of the thigh, not a single twinge of pain was felt until fifty minutes after the insertion of the needle, when cutaneous sensibility began to return, and the last few stitches were slightly painful. The spinal anæsthesia was produced whilst lying on the left side, and during the operation I found that there was not complete loss of sensation in the left leg, and that there was slight power of movement in the left foot. Slowly sensation began to return to the limbs, with the same tingling in the feet. I felt no nausea or unpleasant symptoms of any kind, and half an hour after leaving the theatre I was enjoying a cup of hot coffee and a cigarette, feeling very comfortable, and thoroughly convinced of the tremendous advantages of stovaine over chloroform.

But four hours later I was not so sure about it, for I developed the most appalling headache, which lasted without a break for thirty-six hours, in spite of all treatment. Never have I experienced such a splitting headache, and I hope I never may again. To vary the monotony, I had attacks of agonising cramps in both legs, which lasted for an hour or so and then gradually subsided, to be followed by another attack in a few hours. The cramps became less frequent, the headache wore away, and forty-eight hours after the injection I was my normal self once more.

My experience of stovaine may be exceptional, and as far as I can gather, is so; but if the after-effects of spinal anæsthesia are likely to be as painful and prolonged as they were in my case, then it has no advantages over chloroform. Nothing would induce me to undergo the tortures of that reactionary period again, unless the administration of chloroform was out of the question. I have now tried both, and my experience may be of some interest to readers of the Journal.

A PLEA FOR THE MORE CAREFUL EXAMINATION OF THE SOLDIER'S EARS ON ENLISTMENT.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

Ear diseases are a source of much trouble in military hospitals. A very large number of recruits are undoubtedly passed into the Army who suffer from chronic suppurative middle ear disease which has been existent for many years past. I do not think I have ever seen a case in which I have been able to elicit a history which led me to believe that the disease had originated since enlistment.

The symptoms of acute inflammation of the middle ear are so marked, that one can, by avoiding leading questions, easily eliminate it. The usual history is that the patient has had a discharge from the ear "as long as he can remember," and which doubtless originated in an attack of scarlet fever or measles in childhood. The average strength of the Colchester Garrison for the past year was 3,154, and yet there have been during that time no less than 53 men admitted for middle ear disease of the suppurative type, and 9 for perforation of the tympanic membrane. There cannot be much doubt that the latter cases also had middle ear disease; and it is quite possible that some of the 38 admissions for inflammation of the external meatus, with a total of 461 days in hospital, also suffered from the same disease, but that the perforation had temporarily closed. Some of these external meatus cases remained in for 29, 50, and 54 days. Twenty-nine out of the 62 middle ear cases had less than one years service, and many had less than four months. Forty-three had less than eighteen months, and 52 had less than two years service; 9 were invalided. The total number of days in hospital for middle ear disease amounted to 821, and the residence in some cases amounted to 29, 32, 39, 56, or even 75 days.

There can by no doubt that many of these men should never have been enlisted. I quite admit the impossibility of cleaning the meatus and examining by speculum every recruit who is presented for enlistment. It might be done at stations where a few men appear, but where forty or fifty have to be disposed of in the course of a single morning, it would not be feasible. The acuteness of hearing as measured by a ticking watch, is not a sufficient guide to the probable condition of the middle ear. At the same time, one cannot help thinking that a good many ear cases would be detected if more care were taken by the examining medical officer. I think it may be taken for granted, that any man who has a plug of wax in the external meatus is free from chronic suppurative middle ear disease. By making the man take a deep breath, close his lips and nose, and forcibly expire, the great majority of perforations would be made evident. This is, of course, only Valsalva's method of blowing air up the Eustachian tubes. The

examiner's sense of smell might also be made use of. All neglected chronic suppurative cases are offensive; and if there is carious bone present as well, the odour is very marked. I do not think that any man who shows evidence of operative interference for mastoid trouble should ever be enlisted. One knows how difficult it is to eradicate every particle of diseased bones at the time of the operation, and of the possibility of a relapse of the disease later. We have such a case in hospital at present, who has developed bone symptoms and a return of the discharge, after a radical operation performed in civil life eighteen months ago.

The question now arises, what should be done in the case of men with middle ear disease who have succeeded in enlisting? Whatever the pressure which exists at recruiting stations, and the consequent excuse (to some extent) for overlooking the presence of chronic suppurative middle ear disease, there seems no reason why every recruit should not be carefully examined *by speculum* within a few days of joining his depôt, and the result recorded in his medical history sheet and initialled. Responsibility for chronic disease discovered later, would be fixed in this way. The use of hydrogen peroxide enables one to get rid of impacted wax very easily. This examination would enable a number of men to be got rid of under three months service. If a man was found to have a perforation of either membrane, although he might not at the same time have a discharge from the middle ear, I think he should be got rid of at once. In such cases the disease is only latent. The middle ear is exposed, and infection may occur at any time and light up the trouble.

As regards operative interference with these cases, it is generally accepted nowadays that, in practically every case of chronic suppurative disease of the middle ear, there is suppuration present also in the mastoid antrum, and that the continuance of the middle ear trouble is probably due to drainage from the infected antrum. In order, therefore, to deal satisfactorily with this disease, it is necessary to open up and drain the antrum. I do not think it advisable (except in cases which have become acute or subacute) to attempt these operations on soldiers. The majority would decline to submit to an operation for which they could not see an adequate reason. There would also be the possibility of relapse, and the soldier would be in possession of an operation scar which would be an excuse for his reporting sick whenever he was tired of soldiering, or wanted to shirk some unpleasant duty.

I should be inclined to invalid *at once* any man with less than twelve months service who is found to be suffering from chronic suppurative middle ear disease. In cases with more service than this (provided they do not require frequent admission to hospital) I should suggest passing them to the Army Reserve as soon as possible; it being expressly stipulated that these men are only fit for home service in the event of mobilisation. No man who has had an admission for chronic middle ear disease should ever be allowed to extend his service. It is customary

to forbid the sending of a man abroad who suffers from hernia, but I think it is much more advisable to prevent cases of chronic suppurative middle ear disease from going abroad, or on active service. I would suggest the amendment of the Medical Regulations with this object. When I served in India, I remember what a terrible nuisance these cases were, and how many had to be invalided. In hot countries there are, on account of dust and bathing, many opportunities for the passage of infective material into the middle ear, with consequent lighting up of a quiescent trouble, and one ought to realise what might happen to such cases on active service if they developed acute inflammation of the mastoid antrum, or cerebral abscess.

In 1905 the total admissions for diseases of "Other Organs of Special Sense" (the bulk of which may be assumed to be ear disease) were as follows:—

	Total admissions	Sent home	Finally invalided
United Kingdom	785	—	120
Stations Abroad	1,401	109	81
Total	2,186	109	201

India heads the list with total admissions .. 1,060
" " " " sent home .. 65
" " " finally invalided .. 56

From the above tables it is obvious that an enormous sum is annually lost to the State on account of the prevalence of this particular disease, and one cannot help coming to the conclusion that the bulk of it could be obviated, if more care were taken in the examination of the men on enlistment.

A FEW NOTES ON THE TEACHING OF THE CIRCULATION.

By Captain E. J. EVATT.
Royal Army Medical Corps (V.)

I have found the following method of demonstrating the circulation, and incidentally illustrating some points on respiration, so very helpful in getting the members of my classes to take an intelligent interest in the intricacies of these systems, that I venture to offer these notes to those readers of the Journal of the Royal Army Medical Corps who may be engaged in teaching "first aids," and who have not already anticipated me.

I ask the butcher to get me a sheep's heart and lights (in one), with as much of the wind-pipe and blood-vessels as possible; sometimes the larynx accompanies the trachea, and this piece affords additional material for demonstration purposes. To begin with, the fat is pulled off from the large blood-vessels and the class is shown what these are like; then

something is said about the size, shape and connections of the heart. The trachea is traced to its bronchi, by which a great deal may be learnt of the nature of these structures. Attention is drawn to the small pieces of pleural membrane usually found adhering to the roots of the lungs. The lungs are inflated through the trachea with a bellows or bicycle pump, and the members of the class are invited to feel the lungs so that they may recognise their spongy nature; something is said about the inherent elasticity of the lungs, and an attempt made to explain the mechanism of respiration. The lungs are then cut into, and the course of the bronchi and blood-vessels followed as far as possible.

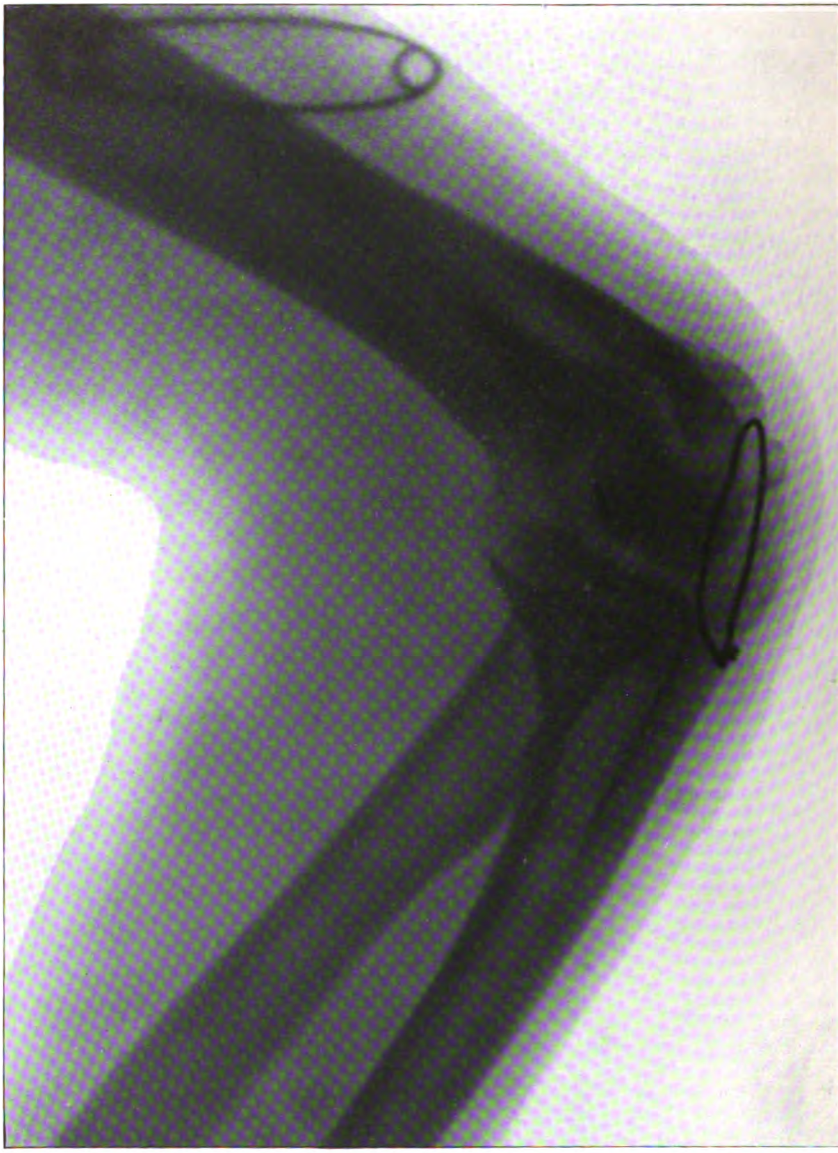
One then turns to the heart; its chambers are opened in the usual way; the orifices, cusps, and musculature of the heart demonstrated, and the course taken by the blood and the function of the valves explained. The pulmonary and aortic cusps are very effectively shown by passing small plugs of cotton-wool behind them. The efficiency of the aortic valve may be tested by tying a piece of glass tubing into the aorta and pouring water into it.

I usually demonstrate the circulation of the blood through the vessels in the mesentery of a frog. An ordinary microscope with a $\frac{1}{4}$ objective is quite good enough for this purpose. One also needs a wooden stage; this may be prepared from a piece of wood $\frac{1}{8}$ inch thick (a little narrower than the microscope stage and long enough to support the frog), and a piece of cork $\frac{1}{2}$ inch high; holes about the same size as that in the stage of the microscope are made through the centre of the wood and of the cork, the cork is cemented to the wood, so that the holes are in line; and finally, a circular cover-slip is fixed over the hole in the cork. The frog is killed by pithing, and when the heart and abdominal contents have been exposed by an incision along the side of the body it is placed on the wooden stage. A coil of intestine is drawn out and the mesentery of the loop spread over the cover-slip on the top of the cork; the whole is then placed on the microscope, and when the light has been adjusted and the mesentery focussed, the blood is seen circulating through the vessels.

NOTES ON SOME SURGICAL OPERATIONS PERFORMED IN YORK AND THE NORTHERN COMMAND.

By Captain W. A. WOODSIDE.
Royal Army Medical Corps.

The following notes on some surgical operations performed in York and the Northern Command during a tour of general duty may be of interest, as the conditions under which they were undertaken are those which are met with in the smaller military hospitals, where no special facilities for operative procedure, beyond the excellent equipment of instruments, dressings and sterilising apparatus, which are supplied to all



Fractured Olecranon wired in position.

To illustrate "Notes on Surgical Operations performed in York and the Northern Command."

By Captain W. A. Woodside, R.A.M.C.

military hospitals, exist. Most of the cases have been done in a corner of the General Surgical Ward, where cases of all kinds, septic and aseptic, were under treatment. These circumstances entailed strenuous work by the nursing staff, who had, practically, to get the whole ward of thirty beds clean enough to be used as an operating room. This was done by systematically disinfecting every bed after being vacated by a patient, and by thoroughly washing and scrubbing the walls, windows, furniture and floor of the ward, and by boiling or otherwise sterilising all the utensils and surgical material used in the ward. This was attended with very happy results, for, when culture plates were exposed in this ward for twelve hours, on various occasions, by the Specialist Sanitary Officer, who carried out the experiments, no colonies of a pathogenic nature could be discovered after the plates had been incubated. This justified one in undertaking operations other than emergency cases. The use of local anæsthetics and the help of skilled nurses, have at times enabled me to dispense with anæsthetists and other skilled assistance; this is of some importance in a hospital with a limited staff where the ordinary routine hospital and garrison duties must be carried out.

Operations.—Two cases of fracture of the olecranon were wired with satisfactory results. In one of the cases full movement of the elbow-joint was undertaken voluntarily, and without pain, fourteen days after the operation. One case of dislocation of the acromio-clavicular joint, with much displacement, which was easily reduced but could not otherwise be retained in good position, was cut down on, and the bone drilled and wired in position. The result was satisfactory. The patient was able to hunt and play golf after five weeks, three of which were spent on sick leave. A case of fracture of the second metacarpal bone, united in faulty position, was re-fractured and retained in corrected position by means of steel pegs. A case of unusual displacement in fracture of the clavicle, occurred in a man who fell on the edge of a form on which he was doing a "long-arm balance": the proximal end of the fractured bone was driven upwards and backwards and imbedded firmly in the trapezius muscle. As no amount of manipulation could bring the fractured ends together, an operation was undertaken on the tenth day after the injury and the fractured bone screwed together with a screw nail. In all these cases the wounds healed without suppuration.

One tubercular testicle was removed under a local anæsthetic; and one atrophied and undescended testicle was removed from the inguinal canal, during an operation for the radical cure of hernia. Both wounds healed without suppuration. The knee-joint was aspirated successfully in one case of severe injury with much hæmorrhage into the joint. A piece of brass cartridge case was removed from the knee-joint under a local anæsthetic. The wound healed without suppuration. Six tumours of a non-malignant type were successfully removed. Two operations for

appendix abscess were performed. In one case a fæcal fistula formed, and two plastic operations were subsequently undertaken. The wounds healed by granulation. Two cases of compound dislocation of the thumb were reduced, and have now got good use of the joints. Bassini's operation for the cure of hernia was performed on eight cases, with satisfactory results, the wounds healing in every case without suppuration. In one of the cases two operations (under local anæsthetics) had subsequently to be undertaken for the removal of silk ligatures, which caused a small superficial abscess. On removal of the ligature the wounds healed by granulation. One of the hernia cases had Bassini's operation performed under a local anæsthetic. Slight abdominal pain was experienced by the patient when some 2½ inches of omentum, which were found in the sac, were dragged on prior to ligature and removal. Ganglions were removed from the wrist in two cases. The wounds healed without suppuration. Five cases were successfuly operated on for the cure of hæmorrhoids. Two cases of *fistula in ano* were operated on; one case required a second operation. Both recovered and returned to duty. Internal urethrotomy was performed in one case with a satisfactory result. One case of excision of the head of a first phalanx for hammer-toe was successful. The wound healed without suppuration. Two operations for empyema, with removal of portions of ribs, were successful. One case of tubercular abscess was opened on the outer side of the thigh, and more than 40 ounces of pus evacuated. The cavity was drained and healed in a few weeks by granulation. The opsonic index in this case was estimated for tubercle bacillus at the Royal Army Medical College at the time of operation, when it was 0·7, also after the wound had granulated up, when it was 0·9. No tuberculin was used. The man recovered and returned to his home, but was marked unfit for further service in the Militia. Amputation through the thigh was performed in one case of septic infection of the knee-joint, following on old-standing necrosis of the lower end of the femur, which had existed for two years. He is still in hospital. Deep abscesses of the neck and of the ischio-rectal fossa, were opened and scraped, where necessary, in five cases. One case of enlarged cervical glands resembling Hodgkin's disease, had thirty-three glands removed from the right side of his neck. The average size was as large as a pigeon's egg. The wounds healed without suppuration. Numerous other glands became enlarged, and the patient was eventually invalided. A case of old fracture and necrosis of the right parietal bone, followed by local abscess, resulting in paralysis of the left leg and arm, was operated on, and the depressed bone removed. The dura mater was not opened. The wound was septic at the time of operation; the patient remained in a critical condition for a considerable period, but eventually recovered and was invalided from the Army. One case of sinus, the result of caries due to tubercular disease of the internal malleolus, was laid open

and scraped. The wound, which healed rapidly after the operation, broke down again. However, after Bier's congestive treatment had been employed for some time it healed firmly. The result was satisfactory. One case of hydrocele of the cord was operated on with satisfactory result, the sac being removed from the inguinal canal. Two cases of varicocele were operated on with satisfactory results. A case of soft cataract of four years standing was removed with very satisfactory result. He returned to duty. A case of recurrent hepatic abscess was operated on, the cavity being drained through the abdominal wall. There was a previous history of an abscess having burst into the lung. The case was a very severe one, large quantities of pus being evacuated. The patient had quite recovered nine weeks after the operation, and went on furlough, and has since returned to duty.

These are the principal operations which have been performed during the period under consideration, but numerous minor operations, such as removal of ingrowing toe-nails, excision of varicose veins, amputation of injured fingers, circumcisions, and removal of enlarged tonsils, done under local anæsthetics, have been performed at different times.

A CASE OF PHALANGEAL NECROSIS.

By Captain J. B. CLARKE.
Royal Army Medical Corps.

Private W. C., Depôt West Riding Regiment, was admitted to the Military Hospital, Halifax, on November 14th, 1907, complaining of pain in his right index finger. He stated that a fortnight before he had scratched it on a splinter of wood, and two days previous to admission it had become painful. The finger was red and swollen about the ungual phalanx and there was some cellulitis about the hand and forearm, the epitrochlear gland being enlarged. Boric fomentations and an arm sling were applied.

On November 18th the cellulitis had subsided and fluctuation appeared on the inner side of the nail. A ½ inch incision was made, about two drachms of pus coming away. This relieved the pain immediately, and boric baths and fomentations were continued.

By November 26th, fluctuation had appeared on the other side of the finger, and on incision about two more drachms of pus came away. Nothing could be felt with a probe.

On December 10th, two sinuses remained discharging a little, and the whole of the terminal phalanx came away through the sinus of the second incision. The finger then healed rapidly, and on December 23rd the patient was discharged to duty.

The finger does not appear to be much deformed and there is free

flexion and extension. The nail remains perfect. The bone is not eroded, and it would appear that the condition might be due to a subperiosteal suppuration with total separation of the periosteum from the bone and death of the latter, such as sometimes occurs in the tibia when the whole shaft between the epiphyses is cast off.

A CASE OF MOVABLE KIDNEY TREATED BY NEPHRORRHAPHY.

By Captain J. F. C. MACKENZIE.
Royal Army Medical Corps.

Osler, in his "Practice of Medicine," describes a kidney as *movable*, when the hand of the person examining can be slipped above the upper end of the organ, and suggests that the term *floating* is appropriate to a kidney which can be moved to or past the mid-line of the abdomen, or below the umbilicus. Other writers limit the term floating kidney, to the condition where a mesonephron is present, In the case described, the kidney could be moved to and beyond the mid-line of the abdomen; but no mesonephron was revealed at the operation.

The patient, Mrs. B., aged 23, nullipara, and married eighteen months, complained of: (1) Severe dragging pain in the back and right side, the pain shooting round the right lower costal margin; (2) distressing throbbing in the stomach; (3) indigestion; (4) dysmenorrhœa.

History of Case.—Always had fairly good health until she came to India, nearly three years ago. First illness, fever contracted "through sleeping in the same room as a child suffering from malaria." Since that time she had not enjoyed good health. Eight weeks after marriage she had an abortion (?), and dysmenorrhœa, which had always been complained of slightly, became more severe. About six months ago she had a fall from a bicycle, and in falling sustained a wound of the vulva, which bled very profusely. Shortly after this, attacks of diarrhœa and pain in the back caused her so much trouble, that she consulted Captain F. Clarke, R.A.M.C., who, in course of examination, discovered the right kidney to be movable. I saw her a month after this, and she then complained of the discomfort of the kidney, which moved about most freely, in spite of pads designed to keep it in position, and which often woke her up suddenly at night, by seeming, as she described it, "to fall over on top of her stomach." She at this time complained of frequent attacks of fever, with diarrhœa and frequent micturition.

On Examination.—Patient looked well nourished. Right kidney could be felt easily, and moved easily, and if the patient moved on to her left side, it immediately rolled over as far as the mid-line of the abdomen. It could also be moved down as far as the umbilicus. Aortic pulsation well marked in the abdomen; micturition frequent; urine 1005, acid, no albumin; no

pus; no blood. Tongue foul and coated heavily. Signs of dilated stomach found on examination. Heart and lungs normal. Uterus anteverted. This probably accounted for the dysmenorrhœa, which had not been relieved by a pessary, which had been worn for about three months. This pessary was removed.

A blood examination revealed benign tertian parasites. A noticeable feature, also, was the marked increase in the number of coarsely granular eosinophiles. As attempts at keeping the kidney in place by pads had been unsuccessful, it was determined, after consultation, to attempt to fix it.

Operation.—Under chloroform, having put a pad in the left loin, a vertical incision was made, from a point one fingers breadth below the last rib, down to a point one fingers breadth above the middle of the crest of the ilium. The line of this incision was about a fingers breadth external to the outer border of the erector spinæ muscle. On deepening the wound, a few fibres of the latissimus dorsi were divided at the upper end, and at the lower end a few fibres of the external oblique. These muscles were strongly retracted and the incision continued down through the lumbar fascia, posterior to the origins of the internal oblique and transversalis. These muscles and the quadratus lumborum were now retracted, and the retroperitoneal fatty tissue surrounding the kidney opened into. The posterior surface of the ascending colon was now to be seen, and a packing was inserted to keep it out of the way. The kidney was now felt for and found, being hard to get hold of on account of its free mobility. A hand firmly pressed on the abdomen, however, kept it from diving away, and with a little difficulty it was drawn up into the wound after being freed from the small quantity of perinephritic fat surrounding it. It had rather an unhealthy appearance, as if it had suffered by its excursions into unusual regions. It was fixed as follows: The capsule of about half the convex surface was stripped by a vertical incision 1½ inches in length, joining two transverse incisions of the same length. The capsule stripped easily and cleanly. The flaps of stripped capsule were then turned back on themselves, so as to bring the surface originally next the kidney, outwards. A kangaroo tendon suture was then threaded through each of the flaps, so as to keep them back, leaving raw kidney exposed. Then two kangaroo tendon sutures, one at either end of the kidney, were carried right through the kidney substance, at a depth of about ½ inch from the surface. The kidney at either end, where these sutures pierced, had not been stripped of capsule. These sutures were now carried through the deeper retracted muscles. The upper suture was taken up as near the lower margin of the last rib as possible, the suture on the posterior capsular flap, being attached to the quadratus lumborum, and the anterior flap suture to the transversalis and internal oblique muscles. The lower of the two sutures, which penetrated the kidney substance, was carried through the transversalis and internal

oblique on one side, and the quadratus lumborum and the lumbar fascia on the other side. These sutures were now all tied and divided. The tying of the deep kidney sutures, *i.e.*, the sutures at either end, drew the retracted muscles together. Four silkworm-gut sutures were now introduced from the surface, catching up the deep muscles and thus further drawing them together. A few horse-hair sutures completed the closure of the skin wound. No drain was inserted. During the operation there was a little oozing from the punctures made by the needle penetrating the kidney substance, but this did not persist.

Very little shock attended the operation. A saline injection (saline 10 ounces, brandy ½ ounce, and tinct. opii, 25 minims) was given *per rectum* after the operation, and this was continued four-hourly until midday next day, without tinct. opii. The urine was drawn off by catheter for two days to prevent movement; quantity and quality normal. Very little pain. Sutures removed on the seventh day. Wound healed perfectly. A severe attack of urticaria, which came on three days after operation and worried the patient considerably, lasting for over a week, was interesting, in view of the increased number of eosinophiles. The patient was allowed up with a firm binder and pad after seventeen days.

After Progress.—Most satisfactory. Patient was able to get about quite comfortably, and the fixing stood the test of a somewhat severe cold with a racking cough, which she contracted after leaving hospital. There was also an attack of malarial fever, but all through these the wound has not troubled her. The indigestion, diarrhœa, and frequency of micturition have not been complained of since the operation, although they had resisted appropriate treatment previously.

Two months after operation the kidney could be felt firmly fixed in its new position, and there was every reason to think that it would remain fixed.

Comment.—The difficulty in keeping a movable kidney in place by a pad is well known, and I have never seen one satisfactorily held by this means. This woman, latterly, scarcely dared to stand up for fear of the pain caused by the slipping organ. The advantages of the procedure carried out are, the comfort and bloodlessness of a vertical incision for exploration of the kidney, and the small amount of damage done to the muscles. The typical train of symptoms was present in this case, with pain and frequent micturition. The digestive disturbance was possibly due to dragging. Aortic pulsation is mentioned as a very frequent symptom.

Shortly after this the patient became pregnant, and when last seen pregnancy was progressing quite satisfactorily.

I am indebted to Colonel H. K. McKay, C.B., I.M.S., and Lieutenant-Colonel F. W. Hall, R.A.M.C., for their kind assistance in the operation, and to Major L. Way, R.A.M.C., for the skilful way in which he gave the anæsthetic, only 7½ drachms being required.

REPORT ON A CASE OF DEATH FROM ACUTE PANCREATITIS.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

Serjeant-Major B., R.F.A., aged 36, was admitted to the Military Hospital, Colchester, on January 7th, at 10 a.m.

Previous History.—Nineteen years ago he had a sudden attack of pain, referred to the umbilicus, lasting three or four days, and which kept him in hospital for ten days. He had no further attack until July, 1907. While walking about, he was suddenly seized with severe pain, referred to the umbilicus, and attended by severe vomiting. This attack lasted four days. Third attack, October, 1907. Fourth attack, December 18th, 1907. The two latter were similar to the others, but only lasted for two days. Fifth attack, January 3rd, 1908. Sudden onset of epigastric pain, with vomiting five hours later; the latter symptom became very prominent. He remained in his quarters for two days, and on January 6th he walked to the inspection room (a distance of 50 yards) and reported sick. The medical officer thought that the patient was suffering from some obscure illness; but as the latter was anxious to remain in his quarters, did not insist on his going to hospital.

On admission next morning, but for the fact that he had no radial pulse, and that his skin was extremely cold, he did not appear acutely ill. He vomited a little bile soon after admission. There was no jaundice. The liver was definitely enlarged, and there appeared to be a localised tender swelling about the tip of the fifth right costal cartilage, which was thought to be the distended gall-bladder. The upper part of the abdomen was tender on pressure and slightly distended, but these symptoms were not marked. The lower part of the abdomen was quite soft, and the whole abdomen moved freely on respiration. Pain was never acute enough to need morphia. At first he was thought to be possibly suffering from biliary colic, and that his previous attacks had been of the same nature. One could not, however, explain his want of pulse and low temperature. An enema acted freely. Saline solution was freely exhibited, both subcutaneously and *per rectum.* About 3 p.m. the vomiting became incessant and bloody. He died about 7 p.m. on the day of admission. The urine was, unfortunately, not examined.

A post-mortem examination was made seventeen hours later. On opening the abdomen, a quantity of dark, odourless, blood-stained fluid escaped. The lustre of the upper part of the cavity was much dulled. *Great omentum* thickened and greasy. *Transverse colon* much distended, walls thickened, œdematous and discoloured in places, especially towards the left. *Stomach* walls thickened; mucous membrane very hæmorrhagic, with a patch on the posterior wall, about $\frac{1}{8}$ inch thick, firmly

adherent to the pancreas and thickly covered by lymph. *Duodenum:* Mucous membrane very hæmorrhagic.

The jejunum was covered with thick yellow lymph at its attachment to the vertebral column. For a distance of about 18 inches below this the bowel was much distended, and its mucous membrane hæmorrhagic. The bowel below this appeared normal. *The lesser cavity of the peritoneum* had a peculiar œdematous, sloughy, yellow appearance. The *pancreas* weighed 7¾ ounces (normal 3 ounces). It was of a peculiar yellow colour, but not soft. The most intense changes were towards the tail and centre. No hæmorrhages were visible, but it was not cut across. The fat round the left kidney and the remains of the left suprarenal body were œdematous, yellow and necrotic, but there were no signs of an abscess. *Liver* weighed 71 ounces, and was very fatty. Gall-bladder yellowish; no calculi. *Spleen* quite normal.

The Pathologist, Royal Army Medical College, reported that the pancreas showed numerous areas of hæmorrhagic effusion and necrosis, but no signs of previous attacks of pancreatitis, as evidenced by the presence of an excessive quantity of fibrous tissue, could be found.

Remarks.—None of the officers doing duty at Colchester had ever seen a case of this rare disease. It was realised that some abdominal catastrophe had occurred, but the man's condition forbade anything in the nature of exploration. A puzzling feature of the case was the history of four previous apparently similar attacks, from which he had rapidly recovered. The text-books admit the possibility of previous attacks of acute pancreatitis. According to Moynihan, whom I cannot do better than quote at length, "the symptoms are those of an *acute epigastric peritonitis*. The condition is to be suspected when a previously healthy person, or a sufferer from occasional attacks of indigestion, is suddenly seized with violent pain in the epigastrium, followed by vomiting and collapse, with, in the course of twenty-four hours, a circumscribed epigastric swelling, tympanitic or resistant, and slight rise of temperature. The onset is always acute, collapse and pain are well marked, and arrest of intestinal movement soon follows. The patient's appearance suggests a diagnosis of other abdominal catastrophes, such as perforation of duodenal or gastric ulcer, or acute intestinal obstruction. As soon as the abdomen is opened, a deeply blood-stained fluid will escape. The omentum presents small, round, white or pale yellow patches of fat necrosis. The pancreas is engorged with blood, soft, swollen and purplish. The disease may be due to blocking of the ampulla by a small calculus, and the consequent conversion of both bile and pancreatic ducts into a common one. Infective bile sets up the inflammation. The treatment consists in making free multiple punctures into the pancreas, and free drainage by gauze. Removal of the stone can hardly be carried out, so cholecystectomy is advisable. If intestinal paralysis is marked, do typhlotomy."

ON A DARK VARIETY OF THE TSETSE-FLY (*GLOSSINA MORSITANS*) FROM THE BAHR-EL-GHAZAL PROVINCE.

BY MAJOR G. DANSEY-BROWNING.
Royal Army Medical Corps.

DURING the winters of the years 1905 and 1906, while on duty for the Sudan Government Sleeping Sickness Commission, I had the opportunity of travelling in the western district of the Bahr-el-Ghazal Province. Whilst marching between the village of Sultan Keango and the village of Kossinga in that district, I captured several specimens of what is, I believe, a hitherto undescribed variety of *Glossina morsitans*. Since my return to England, I have availed myself of the kindness of the authorities of the British Museum and of the Liverpool School of Tropical Medicine, which has enabled me to compare my specimens with those contained in their collections, and to observe the marked difference in their coloration, which I originally noticed during life.

Although this alteration of colour was not due to *post-mortem* changes, an eminent authority, who was good enough to favour me with his opinion, thought that my specimens were simply discoloured examples of *G. morsitans*. Another entomologist, however, considers that the differences are so marked, that they seem to him to be worthy of description.

The fly is a dusky black glossina, somewhat similar in size and colour to *G. palpalis*, but differing markedly from that species as regards the coloration of the tarsi, these being specifically identical with the tarsi of *G. morsitans*. The posterior surface of the head is dusky black, not dusky grey, as in *G. morsitans*. The thorax and pleuræ are distinctly dusky black, not dusky grey. The abdomen is markedly darker than in *G. morsitans*, particularly as regards the second segment. On this, the pale area found in *G. morsitans* is replaced by a peculiar dusky area, with irregular black confluent blotches on a dark ochraceous background. The abdominal bands are generally deeper than in *G. morsitans*, and the hind margins of the segments are narrower, and generally more dusky in appearance.

In other respects my specimens appear to be similar to the *G. morsitans* found in the above collections. The district in which these flies were captured abounds in *G. morsitans*, and transport animals on the march suffer severely from the effects of trypanosomiasis. No example of the tsetse-fly, *G. palpalis*, is found within a distance of, roughly, 150 miles. The specimens I describe were captured in dense forest, in the immediate vicinity of rain-water pools. They were not found near the banks of rivers, nor within 20 miles of any habitation.

THE ENTOMOLOGICAL COLLECTION AT THE ROYAL ARMY MEDICAL COLLEGE.

By Lieutenant-Colonel N. MANDERS.
Royal Army Medical Corps.

The following insects have recently been incorporated with the collection of blood-sucking Diptera at the Royal Army Medical College:—

Name of insect	Name of donor	Locality	Number of specimens
Culex fatigans	Dr. Balfour	Khartoum	2
Anopheles nili	,, ,, ...	,, ...	1
,, *uniformis* ..	,, ,, ...	,, ...	3
,, *paludis*	,, ,, ...	,, ...	1
,, *funesta*	,, ,, ...	,, ...	2
,, *wellcomei* ..	,, ,, ...	,, ...	1
Culex cantans	Lieut.-Col. Leishman	England	1
Anopheles bifurcatus ..	,, ,, ,,	,, ...	2
,, *maculipennis* ..	,, ,, ,,	,, ...	5
Ceratopogon varius	,, ,, ,,	,, ...	5
,, *pulicaris* ..	,, ,, ,,	,, ...	1
,, *obsoletus* ..	,, ,, ,,	,, ...	1
Tabanus secedens	Capt. Fitzgerald ..	Batkanu, W. Africa	1
,, *socius*	,, ,, ..	,, ,,	1
,, *lavarani*	,, ,, ..	,, ,,	1*
,, *obscurissimus* ..	,, ,, ..	,, ,,	1
Culex fatigans	Col. Peterkin.. ..	Mauritius	38
,, *tigripes*	,, ,, ...	,, ...	27
Stegomyia fasciata	,, ,, ...	,, ...	14
,, *scutellaris* ..	,, ,, ...	,, ...	2
Anopheles mauritiana ..	,, ,, ...	,, ...	12
,, *costalis*	,, ,, ...	,, ...	2
Stomoxys nigra	,, ,, ...	,, ...	15
Corethra pallida	,, ,, ...	,, ...	3
And one specimen not yet determined.			
Hæmatopota pulcrithorax ..	?	?	3
And two specimens of *Hæmatopota* not yet determined.			

* Recently discovered.

I have also to acknowledge the receipt of a collection, through Lieutenant-Colonel Leishman, from Captain F. H. Hardy, R.A.M.C., from Central Africa, which is being dealt with.

Reports.

RECORD OF ANTI-TYPHOID INOCULATION PERFORMED ON THE THIRD BATTALION COLDSTREAM GUARDS, SEPTEMBER, 1906, TO OCTOBER, 1907.[1]

By Lieutenant J. H. GRAHAM.
Royal Army Medical Corps.

The 3rd Battalion Coldstream Guards embarked at Southampton, for Egypt, on September 29th, 1906, and disembarked at Alexandria on October 11th, proceeding to Abbassia Barracks, Cairo, the same day. The strength of the battalion for statistical purposes is given below.

Method of Inoculation.—An ordinary serum syringe, graduated in cubic centimetres, was used. The syringe was sterilised by filling it with oil heated to a temperature of 140° C.—the barrel once before vaccine was drawn into it and the needle after each inoculation. The barrel was then allowed to cool, and the needle dipped in sterilised cold water before drawing any vaccine into the syringe. The rubber cap of the bottle containing the vaccine was first sterilised by dipping it in oil at a temperature of 140° C., then punctured in two places by the needle, and the vaccine drawn up into the syringe through one of the punctures. As far as possible the second inoculation was performed ten to fourteen days after the first.

Site of Inoculation.—The site chosen was the left flank. The skin of the flank was sterilised by methylated spirit and carbolic lotion. There were no cases of suppuration.

Reaction.—Very few of the cases presented a severe reaction. The men were excused duty for two days, nearly all being able to return to duty on the third. Calcium chloride was not given (with a view to limiting serous effusion). Each man was warned not to take active exercise or to drink alcohol in any form for forty-eight hours.

Strength of the Battalion.—The strength indicated here was obtained by taking the average of the monthly strengths:—

19 Officers; 693 W.O.'s, N.C.O.'s and Men.

The strength of Officers varying from 15 – 25.
The strength of W.O.'s, N.C.O.'s and Men from 680 – 705.
The number of Women and Children, 28 and 39.
The number of Officer's Wives and Children, 3 and 1.

Number of Inoculations.—During the period under consideration 6 officers were inoculated twice in the ordinary way, 3 only once; 288 men

[1] Being a Report of the Anti-Typhoid Inoculation Committee of the Army Medical Advisory Board.

twice, 34 only once. Total 331. The cases having only one dose of vaccine, either refused their second or were absent (*e.g.*, in hospital), when their second inoculation should have been performed. From October, 1906, to April, 1907, the inoculations were carried out by myself; afterwards, when I went to the Military Hospital, Cairo, for duty, the inoculations were performed by Major Erskine, R.A.M.C., Medical Officer in Charge of Troops, Abbassia.

Cases of Enteric Fever.—There has been no epidemic of enteric fever, but 15 cases have occurred at intervals amongst the Officers, W.O.'s, N.C.O.'s, and men. Of the 15 cases, 2 had been inoculated; 1, an officer, inoculated once (one dose) in December, 1899; the other, a man who received two doses eleven months before his attack. The remaining 13, one of whom died, had not been inoculated. In addition to the above, two wives of men of the battalion contracted enteric fever; both recovered. In the following table the officer's case is not included, as his inoculation was performed eight years before. The cases of the two women mentioned are also not included.

Interval between inoculation and commencement of period of exposure	Place where Battalion was exposed to infection	Number of inoculated and uninoculated in the Battalion		Number of cases of enteric fever		Percentage incidence of the disease		Number of deaths from typhoid fever		Percentage death-rate for enteric fever		Case mortality, 1·9. Proportion of deaths to cases	
		Inoculated	Uninoculated	Inoculated	Uninoculated	Inoculated	Uninoculated	Inoculated	Uninoculated	Inoculated	Uninoculated	Inoculated	Uninoculated
No interval	Egypt	331	381	1	13	·3	3·4	0	1	0	·26	0 in 1	1 in 13

BRIEF NOTES ON CASES OF ENTERIC FEVER.

No. 4568 *Private Staples* (*aged* 25).—Admitted to hospital with dysentery, December 1st, 1906. Transferred to enteric ward, December 29th, 1906. *Not inoculated:* bronchitis severe; no enlargement of spleen or liver; enteric spots. Widal's reaction positive, 1 in 50 dilution. Invalided to England, March 5th, 1907.

No. 6062 *Private Mitchell* (*aged* 21).—Admitted to hospital December 30th, 1906. Prolonged attack; mild pyrexia; spleen not palpably enlarged; stools normal; during convalescence slight swelling of left leg and ankle. *Not inoculated:* Widal's reaction, January 3rd, 1907, negative, 1 in 50; January 18th, 1907, positive, 1 in 50. Discharged hospital, April 27th, 1907.

No. 9688 *Serjeant Richardson* (*aged* 31).—Admitted to hospital, January 2nd, 1907. Had been discharged a fortnight before from hospital, convalescent from dysentery. *Not inoculated.* Widal's reaction slight, positive, 1 in 50. Discharged hospital, March 2nd, 1907.

No. 5946 *Private Netherway* (*aged* 22).—Admitted to hospital, March

26th, 1907. Very severe case. Widal's reaction positive, 1 in 50. *Not inoculated.* Died on the twenty-eighth day of the disease from exhaustion and acute distension. *Post Mortem:* Heart muscle flabby and wasted; Ulceration of ileum and ascending colon; there was a small perforation in the wall of the cæcum, but no general peritonitis; spleen not markedly enlarged.

No. 5893 *Private Clark* (*aged* 22).—Admitted to hospital, April 9th, 1907. Fairly severe attack; no complications. *Not inoculated.* Widal's reaction, positive, 1 in 50. Transferred to Alexandria, July 1, 1907.

No. 3197 *Private Yarde* (*aged* 27). Admitted to hospital, April 12th, 1907. Mild attack, with severe relapse during the fourth week of convalescence (twenty-seventh day of normal temperature), commencing with tonsillitis. *Not inoculated.* No complications. Slight œdema of legs during early convalescence. Transferred to Alexandria, August 17th, 1907. Widal's reaction positive, 1 in 50.

No. 5347 *Private Hastings* (*aged* 23). Admitted to hospital, April 12th, 1907. Mild attack; no complications. Widal's reaction positive, 1 in 50. *Not inoculated.* Discharged hospital, June 27th, 1907.

No. 9299 *Private Little* (*aged* 22). Admitted to hospital, April 18th, 1907. Mild attack; no complications. *Not inoculated.* Widal's reaction positive, 1 in 50. Discharged hospital, June 29th, 1907.

Lieutenant Jervis Smith (*aged* 27).—Admitted to hospital, May 4th, 1907. Mild attack; no complications. Widal's reaction positive, 1 in 50. Sick leave to England, July 2nd, 1907. *Inoculated once, December*, 1899.

No. 3441 *Private Scott* (*aged* 25).—Admitted to hospital, May 10th, 1907. Mild; no complications; prolonged convalescence with weak pulse and considerabie anæmia. *Not inoculated.* Widal's reaction positive, 1 in 50, May 14th, 1907. Transferred to Alexandria, July 1st, 1907.

No. 6225 *Private Whatling* (*aged* 22).—Admitted to hospital, June 14th, 1907. Mild attack; mild relapse on thirteenth day. *Not inoculated.* Widal's reaction positive, slight, 1 in 50, June 23rd, 1907; complete, 1 in 50, June 29th, 1907. Transferred to Alexandria, October 9th, 1907.

No. 6087 *Private Dawson* (*aged* 22).—Admitted to hospital, July 25th, 1907. Mild; well marked bronchitis. *Not inoculated.* Widal's reaction positive, 1 in 50, July 31st, 1907. Sedimentation test, positive. Transferred to Alexandria, October 9, 1907.

No. 6338 *Private Morrish* (*aged* 21).—Attack supervened, September 15th, 1907, whilst the patient was under treatment for bronchitis. *Not inoculated.* Original admission to hospital, August 11th, 1907. Ordinary severity. Marked bronchitis. Very slow pulse during convalescence. Cystitis with irregular pyrexia during convalescence. Widal's reaction positive, 1 in 50. Not yet discharged from hospital.

No. 6472 *Private Prescott* (*aged* 19).—Admitted to hospital, September 27th, 1907. Ordinary attack. Widal's reaction, negative, September 30th, 1907; positive, 1 in 40, October 7th, 1907. *Inoculated;* first dose, October

18th, 1906, 1 cc.; second dose, October 29th, 1906, 2 cc. (date of preparation, May 17th, 1906). Not yet discharged from hospital.

No. 3405 *Private Arbury* (*aged* 26).—Admitted to hospital, October 8th, 1907. *Not inoculated.* During convalescence there occurred rises of temperature which subsided in a few days, for which no definite cause was found. Widal's reaction positive, 1 in 50, October 20th, 1907. Considerable anæmia was present in this case; a differential count of leucocytes showed no change from normal. The anæmia is now improving. Still under treatment in hospital.

The cases of the two women were both mild; and both gave a positive reaction to Widal's test.

REVIEW OF THE SURGICAL OPERATIONS PERFORMED AT THE MILITARY HOSPITAL, CURRAGH CAMP, 1907.

By Major F. E. GUNTER.
Royal Army Medical Corps.

During the year 1907 two hundred and six operations were performed; of these cases four died, four were invalided, and the remainder recovered.

The following notes on cases are published as being of interest:—

Fracture of Fibula.—Private R., admitted into hospital on March 2nd, as a result of an injury caused by his horse falling with him. On examination there was marked tenderness about the head of the fibula, which was very prominent.

On March 7th an incision was made exposing the head of the fibula. The capsule of the knee-joint was found to be torn. The fractured portion was small, but included the insertion of the biceps. The shaft of the tibia was exposed and a wire passed through this and brought out above the fractured fragment, and twisted. The tendon of the biceps was sutured to its prolongation to the tibia, and the wound closed. The wire was passed through the tibia instead of the fibula, as it was found to be much easier to do this. The main point about the operation was to secure a firm insertion for the tendon of the biceps. The patient made a good recovery, and was discharged to sick furlough on May 15th.

Fracture of Lower Jaw—Private N., admitted into hospital on December 26th, 1906, with a compound fracture of the lower jaw, left side, just in front of the angle. Union having failed under other treatment, on March 5th the jaw was wired through an external incision. The wire had subsequently to be removed. The patient made a good recovery.

Removal of Cartilage of Knee-Joint.—A considerable number of operations have been performed for displaced articular cartilage of the knee. Needless to say, perfect asepsis is essential. Personally, I never touch the wound from start to finish with the hands, even though gloved. I

never wash out the joint, but generally swab it with gauze. After the operation, a back splint is applied for a day or so, but this is always removed if the patient complains of pain. On removal of the sutures, massage and cautious active movements are commenced. This is most important. The extensors of the leg rapidly waste, and convalescence is consequently delayed if the limb be rested too long. For the same reason I avoid long rest prior to operation.

Rupture of Third Palmar Interosseous Muscle.—Private G. was admitted into hospital on October 7th with an injury to his little finger, which, on examination, was found to be abducted; on flexing the hand the abduction became more marked. It seemed probable that the abduction was caused by a rupture of the third palmar interosseous muscle—the abductor minimi digiti having nothing to oppose its action. In accordance with the above diagnosis the fifth metacarpal bone was exposed by a longitudinal palmar incision. The distal portion of the ruptured tendon was found. The proximal end could not be located, so the distal end was sutured to the flexor tendon. The patient now has fair power in the little finger, and is improving daily.

Trephining for Meningeal Hæmorrhage.—The following case is of considerable interest, and is given in detail. Private M. was admitted into hospital on May 22nd in an unconscious condition, as a result of a fall from a cart drawn by a runaway horse. On admission he was bleeding from the right ear. Temperature 97° F., pulse 45. Breathing slow, but not stertorous; pupils equal. The patient was very irritable, and vomited two or three times. No retention of urine. In the evening his temperature rose and his pulse quickened, but he was quite conscious. The dressings had to be changed several times. There were indefinite signs of right-sided paralysis. Lieutenant A. G. Cummins, on May 25th, took the following careful notes on the case: "Six convulsions between 2.30 and 2.55 p.m. The fits commenced with nystagmus in both eyes. Then there appeared to be some movement of the left hand, which was not convulsive, but more of the nature of an aura. Then, twitching and contraction of the left corner of the mouth; the jaw was markedly drawn over to the left by the contraction of the face muscles. Next, jerking movements of the left hand, arm and shoulder, and convulsive swallowing movements. The right arm and hand seemed to move also, but not in a convulsive manner. The fit lasted about thirty seconds. Had another fit at 3.15 p.m. No more till 5.25 p.m.; this fit commenced with convulsive movements of the left corner of the mouth; next, left arm; later, general; 5.55 p.m. had another fit same as last; 6.30 p.m. ditto; 6.50 p.m. ditto. Pulse continues good and shows no sign of getting slower."

The lesion is apparently one affecting the lower face, tongue and larynx centres especially.

May 29th.—This morning the temporal bone on the right side was trephined 2 inches behind the external angular process and just above

the zygoma. On removing the bone and pressing gently on the dura, blood spurted out. The bleeding point was found with some difficulty, well below the trephined area; owing to its depth, ligature was found impossible, so the forceps were left *in situ*, and the wound plugged with gauze. May 30th.—Much improved. Pulse 80; temperature 99° F. Answers sensibly. May 31st.—Forceps removed. June 1st.—Improving, but cerebration slow; takes 30 seconds before answering. Recollects events up to the time of the accident. From this date the patient made an uninterrupted recovery.

Appendicitis and Duodenal Ulcer.—Corporal C., aged 40, was admitted into hospital on June 6th.

History.—About 1 a.m. he had slight pain in the abdomen. He went straight to hospital at Kildare, where he was detained for the night. He vomited several times during the night. The pain was chiefly about the umbilicus. At Kildare he was given liq. morph. tart., and was transferred to this hospital about 2 p.m. On examination he presented the "acute abdomen," with great pain and tenderness, the latter being in the right iliac fossa and about the umbilicus. Pulse not very quick; temperature a little raised. At 6 p.m. liver dulness was markedly diminished and he was in agonies of pain. Operation imperative. The diagnosis of appendicitis was doubtful, but, as he had decided pain in the right iliac fossa, it was thought advisable to expose the appendix. The appendix, cæcum and small intestine were found to be acutely inflamed. The appendix was perforated at its base; it was removed and the cavity drained.

On June 8th a quantity of bile-stained clear fluid escaped from the wound. Pulse very feeble. The patient appeared to be suffering from severe toxæmia, and died at 3 p.m.

Post-mortem Appearances.—In the abdominal cavity a quantity of bile-stained clear fluid was found. The intestines were inflamed and distended. In the duodenum, close to the pylorus, there was a perforation one-fourth of an inch in diameter, clean and "punched out." The walls were thickened, and it was evidently an old ulcer recently perforated. Neither the duodenum nor the stomach was inflamed.

Remarks.—This was a case of great difficulty. The symptoms on admission were masked by the opium which had to be given to enable the patient to stand the journey from Kildare (4 miles by road). The symptoms in the evening pointed to the appendix, and finding it perforated, one naturally did not look for anything else. Moreover, it is not certain that at the time of the operation the duodenal ulcer had perforated. There was certainly no bile in the peritoneal cavity at the time of operation. It has been suggested to me that at the time of operation the patient had an ulcer of the duodenum which had eaten its way down to the peritoneal coat, and that the paralysis of the gut which followed the operation led to distension of the intestines, and that,

in consequence, the gut gave way at its weakest point, viz., the ulcerated portion. The explanation is feasible. The ulcer, as revealed by the *post-mortem* examination, was chronic, and there were no signs of recent inflammation.

Hernia.—The majority of cases have been treated by ligaturing the sac and overlapping the external oblique aponeurosis. Lately, I have been cutting down directly on the internal ring. A paper by Mr. George Chiene, advocating this method, appeared in the *British Medical Journal* of November 16th, 1907. I had operated on two cases, much on the lines he recommends, before the appearance of his paper. It is too early to state any opinion, from personal experience, on the success of the method; the operation is, however, very simple, and a great saving of time is effected.

Varicocele.—The same incision is made as for radical cure of hernia. The external oblique aponeurosis is slit up and the veins excised; the distal ends of the veins are then sutured to the aponeurosis. This will be found to brace up the testicle much more effectually than simply uniting the proximal and distal ends of the veins. The aponeurosis is then sutured and the wound closed.

Lieutenant D. M. Corbett, R.A.M.C., has suggested a modification of this which is, I think, an improvement, and is the method I now adopt. The veins are pulled down through the external abdominal ring and a portion excised; a Thomas's needle is then passed through the aponeurosis of the external oblique, down the canal, and out at the external ring; one end of the ligature (left long for this purpose), on the distal end of the veins, is threaded through the needle, which is withdrawn along with the ligature; the other end of the ligature is treated in a similar fashion; the ends are then tied, bracing up the testicle as much as may be thought desirable.

Anæsthesia:—

Æther was administered	134 times
Chloroform ,, ,, ...	55 ,,
Local analgesia	20 ,,

The preponderance of æther administration is due to the fact that the choice of anæsthetic was, in most cases, left to the anæsthetist, and the majority of officers who have acted in this capacity have been brought up in Schools where æther is advocated.

Asepsis, in contradistinction to antisepsis, is invariably observed in this hospital, even in dealing with septic cases. Lotions have been discarded, even for purification of the skin. The results have been very satisfactory.

Reprints.

THE TREATMENT OF DYSENTERY.[1]

By Major R. J. BLACKHAM.
Royal Army Medical Corps.

No apology is, I think, necessary for introducing a discussion on this subject before the Royal Institute of Public Health, as not only is it one which is very debateable, but it is one of very real interest to all physicians, whether they have practised in foreign countries or not. The treatment of intestinal fluxes is work which is, or has been, the daily round of all of us, so that in this subject we have a matter for discussion in which the ordinary practising physician can speak with as much weight and perhaps more experience than the eminent climatologist or the famous protozoologist.

Dysentery, as we all know, is a strictly preventable condition, but although we may hope to keep the disability out of our English cities and the field ambulances of armies in the future; in India and other tropical and sub-tropical countries, where we have to deal with a low standard of sanitary environment, dysentery will be the cause of considerable sickness and invaliding for many years to come. The incidence of the disease is, however, happily diminishing amongst British troops in India, as will be seen by the accompanying chart, which shows the admissions and the number constantly sick of the British garrison in India during the period 1896-1905, the last decennium for which statistics are available.

By the term dysentery it is now generally admitted that we include two groups or classes of disease, one being caused by a protozoon and the other by bacilli.

The variety due to protozoa is caused by the *Amœba* or *Entamœba histolytica*, the life-history of which parasite was so ably worked out by Schaudinn, whose untimely death I am sure we all deplore, while the variety due to bacilli is caused by a great variety of micro-organisms, of which the bacillus associated with the name of Shiga may be regarded as the type.

The bacilli of what may be called the dysentery family of bacilli, are the highest section of the *Coli* group of organisms, being even more delicate in their growth than the *Bacillus typhosus abdominalis*, and only distinguished from the enteric organism by their inability to split up special sugars readily attacked by the typhoid bacillus.

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[1] Read before the Douglas Congress, July, 1907. Reprinted from the *Journal of the Royal Institute of Public Health*, February, 1908.

Clinically, the two varieties of dysentery are fairly readily distinguished. Their special characteristics are tolerably clearly shown in the following table :—

DIFFERENTIAL DIAGNOSIS OF AMŒBIC AND BACILLARY DYSENTERY.

Amœbic.	*Bacillary.*
(1) Always chronic in its course.	(1) Acute in onset and running a rapid course in nearly all cases.
(2) Pyrexia rare.	(2) Pyrexia common.
(3) Toxic symptoms not present except when there is liver abscess.	(3) Toxic symptoms usually present.
(4) Liver abscess occurs in about sixteen per cent. of cases (Curry).	(4) Liver abscess never occurs.
(5) Small intestine frequently attacked.	(5) Disease confined to large intestine.
(6) According to Krause and Kartulis, undermined ulcers present.	(6) Ulcers usually found on surface folds of intestine.

In considering the therapeusis of dysentery we are confronted at the outset with a serious difficulty. We find that the treatment of the two varieties of the disease are hopelessly mixed up by nearly every authority, and that it is difficult to differentiate the remedies which are to be recommended in the variety due to amœbæ from those suggested for the bacillary type. In a previous article on the subject (*Lancet*, December 1st, 1906), I was obliged to be content with a division of my remarks under the classical headings of "acute" and "chronic," but in view of the large amount of work which has been done on the subject during the past year I will now endeavour to indicate different lines of treatment for what are, essentially, two different diseases. The type which is acute in its onset naturally claims our attention first, and therefore we will primarily consider

THE TREATMENT OF BACILLARY DYSENTERY.

In approaching the important subject of the treatment of a serious illness it is best to divide our remarks under different headings, indicating the therapeutic lines on which our treatment is based. The indications which will assist us in the treatment of bacillary dysentery are three in number: (1) To relieve the pain and tenesmus and to avoid all irritation of the inflamed mucous membrane; (2) to promote intestinal antisepsis by removing foul accumulations and arresting putrefaction, and (3) to counteract any morbid agency in the blood and support the patient's strength by suitable diet. Let us consider these indications seriatim.

(1) For the relief of pain and tenesmus the use of opium was unhesitatingly condemned by the older writers on acute dysentery; but it is now universally used and recommended by all authorities, and my experience is that the best method of exhibiting the drug is to give a quarter or a third of a grain of morphine hypodermically, repeating the dose every three hours if necessary. I have found this effective in

relieving both tormina and tenesmus, and this appears to be the treatment to be adopted on expeditions or in camp, when suppositories and material for enemata, so strongly recommended by some authors, are rarely available. A recent writer in the *Lancet* emphasises the utility of opium.

The second portion of this indication is to avoid irritation of the inflamed mucous membrane. To meet this indication rest is absolutely essential, and *in all cases* the patient should remain in bed and use a bed-pan. The frequent stools and tenesmus soon produce coldness of the surface and of the extremities, so to maintain the individual's vitality he must be kept warm by means of plenty of blankets and the use of hot water bottles. All foods which leave a residue prone to decomposition must be avoided, and I object even to milk in acute dysentery if the tongue is foul, and prefer to limit the diet to weak chicken-broth, clear soups, whey, and a little egg albumen till the tongue cleans. Milk is considered by Scheube and other Continental authorities the best food in all cases, but I think that British physicians generally are now opposed to it. In all cases clear soups flavoured with the juice of fresh vegetables can be given, as they leave no residue behind and are most grateful to the patient as a change from milk or whey. Ewart and Nash very strongly recommend this kind of broth in the treatment of typhoid fever, and we may take it that the acute variety of dysentery must be treated on much the same lines as enteric fever. Nash says, "too rigid an application of the exclusive milk diet spells disaster in many cases. I can call to mind more than one case of typhoid fever which has been admitted to hospital desperately ill, not so much through disease *per se* as through loading of the intestinal tract with massive milk curds, producing most harmful toxines and mechanical irritation." Stimulants should not be exhibited as a matter of routine. They are rarely necessary, and should only be given in small quantities when the prostration of the patient is very great. A teaspoonful of brandy in a tablespoonful of hot coffee is a good method of exhibiting alcohol.

(2) The second indication for treatment is to attempt to produce intestinal antisepsis. This can, of course, be merely an attempt, as the bowel may be regarded as a forest crowded with flora and fauna of the most varied and septic character; but although it may be useless to try to render the intestinal mucosa aseptic, it may be possible to place it in a position which will discourage the growth of a delicate organism such as the bacillus of dysentery appears to be. There are three ways in which we may attempt to treat this indication, namely: (*a*) by the administration of saline aperients or calomel, which sweep all foul accumulations and organisms from the intestinal tract and inhibit the growth of micro-organisms; (*b*) by the administration of specific sera; and (*c*) by washing out the bowel per anum by means of astringent and antiseptic fluids. In the tropics the best preliminary treatment for all

cases of diarrhœa is a dose of castor oil with or without 15 to 20 mimims of liquor opii sedativus, and I believe that slight cases of dysentery are often checked thereby and require no further treatment, except complete rest and bland, non-irritating diet for three weeks. Having administered castor oil the physician must elect whether he will resort to drug, serum, or lavage methods of treatment.

Treatment by Drugs.—The administration of salines has many adherents amongst officers of the Royal Army Medical Corps serving in India, and in most hospitals in that country mixtures containing a drachm to each dose of either magnesium or sodium sulphate constitute the stock "dysentery mixture." The first is Buchanan's original formula and the latter his modification on discovering that sulphate of sodium gave, on the whole, better results than sulphate of magnesium. The mode of administration is to give a dose of one or other of these mixtures every hour until the motions become fæcal, and then every three or four hours for one or two days. If the stools become watery and show no tendency to take on a fæculent character the saline treatment must be stopped, and serum therapy resorted to. Scheube and Kartulis are strong advocates of calomel in the treatment of dysentery, and in a very recent article Professor Plehn, of Berlin, recommends the use of this drug instead of either ipecacuanha or sulphates. He says that what he calls the "calomel cure" should be commenced immediately the effect of the initial dose of castor oil becomes obvious. It consists in administering ½ a grain of calomel regularly every hour until twelve doses have been taken during the day. The treatment is suspended during the night, and the calomel repeated in the same way during the second and third day. "These doses of 6 grains of calomel per day, administered in divided doses, do not in the least act as a purgative, but on the contrary, they alleviate pain and act as an astringent, sometimes, in very fresh cases, as early as after twenty-four to twenty-eight hours." Perhaps this is explained by assuming that the calomel has a direct lethal effect on the organisms, and, in consequence, the formation of toxin is limited or stopped. "On the third day the excretions have mostly subsided and the subjective discomforts have entirely disappeared. However, the dysentery is thereby not wholly cured, as the uninitiated may be disposed to assume to their cost. The ever present ulcers or diphtheroid coagulation necroses of the mucous membrane of the intestine need far more time for their healing process and subsequent regeneration of the tissues. According to our experience in the treatment of recent cases, this takes at least three weeks. Dangerous complications, in cases of enteritis caused by amœbæ, arise during the healing process by the spread of unexterminated parasites through the portal vein into the liver, forming necroses and abscesses. In diphtheroid dysentery they consist in a reabsorption of toxic products through the surface of wounds. In order to avoid these complications, bismuth should be

administered after the calomel cure, namely, bismuthum subnitricum 6 grains every hour, *i.e.*, ℥iss per day. This treatment should be continued for three or four weeks. We have never observed even a suspicion of intoxication through bismuth" (*International Medical Review*). It would be interesting to know the opinion of English physicians on this so-called "calomel cure" of our German colleagues.

Treatment by Specific Sera.—The specific serum introduced by Shiga has produced splendid results in Japan, where its inventor claims that it has reduced the mortality in "endemic" dysentery from 35 per cent. to 9 per cent. The encouraging early results, moreover, have been well borne out by recent investigations in France.

In the *Annales de l'Institut Pasteur* for April, 1907, two military physicians, MM. Vaillard and Dopter, give an account of 243 cases of dysentery, of which 200 cases were treated in various French hospitals and 43 in asylums by means of serum-therapy during last summer. They recall their opinion, published in the Annals for May, 1906, that their serum was "really a specific agent for the treatment of bacillary dysentery," and state that their experience since that date confirms this opinion.

In support of this view they show that in the 200 cases of ordinary dysentery there were ten deaths, giving a gross mortality of 5 per cent. However, from these deaths may be deducted six cases in which the serum was used when *la situation etait désespérée et la mort prochaine*, giving only four deaths, or a mortality of 2 per cent. They contrast these figures with those of various places where the mortality ranges from 6 per cent. at Toulon to 24 per cent. in Japan, and 50 to 60 per cent. in the environs of Carhaix (Finisterre).

The criterion of the value of the serum does not rest only on the reduction of mortality, but is to be found in the speedy relief of symptoms and the rapidity of cure. The serum quickly relieves the pain and tenesmus and checks the frequency of the stools. At the same time the nature of the dejections changes. The blood first disappears and then the mucus, and after this the resumption of a fæcal character by the stools indicates the approaching convalescence. Its advocates claim that the serum cures serious cases in four to six days, and the most acute in ten to fifteen days.

The sooner the serum is exhibited, the better the prospects of cure, and it is necessary to give it in a quantity suitable to the severity of the case.

MM. Vaillard and Dopter recommend one dose of 20 cc. in mild cases, but give a *traitment intensif* of 50, 80 to 100 cc. in grave cases. In exceptional conditions these huge doses may be repeated the second day.

Forty-three cases of asylum dysentery were treated by the serum, with seven deaths. MM. Vaillard and Dopter summarise the results as follows:—In weak, debilitated, insane persons the serum is not so

efficacious, but in healthy demented individuals very moderate doses produce a rapid cure.

In concluding their article the authors consider that their strong advocacy of the serum in 1906 has been amply justified by their recent experience, and claim that it is really as much a *specific* in bacillary dysentery as antitoxin is in diphtheria, and that its wider use would reduce to a minimum the mortality of dysentery.

Moreover, they state that the serum which cures dysentery is equally capable of preventing it, and strongly advocate the use of prophylactic injections of the drug in places such as Brittany, where the disease annually develops into an epidemic.

In view of this report, which has of course not yet reached the whole of the English-speaking profession, I think the serum-therapy of dysentery must claim a large amount of our attention in the future.

Treatment by Lavage.—Osler says "that the treatment of dysentery by topical applications is by far the most rational plan," but I think this statement requires qualification. It is unquestionably a valuable method of treatment, but it is only applicable in sub-acute and chronic cases, at least in the tropics, where the services of skilled nurses are comparatively rarely obtainable. In the time at my disposal I merely refer to this method under this heading for the sake of completeness. It can hardly claim our serious attention in military practice except in chronic cases, as the results of other lines of the treatment are so good. For instance, Buchanan has treated 855 consecutive cases, which were probably all due to bacilli, by salines with only nine deaths, giving a case mortality of only 1·05, while Vaillard and Dopter have only had a case mortality of 2 per cent. with serum treatment, and these I think are almost as good results as can be hoped for in the therapeusis of an acute illness.

(3) The third indication is to counteract any morbid condition of the blood. This is a most important indication, and one which has recently attracted much attention. Where dysentery occurs in a malarial subject, quinine must be exhibited in full doses, and Maclean went so far as to recommend that 20 grains of quinine should always be administered before other treatment was begun. The morbid condition of the blood which has recently been shown to be most frequently associated with dysentery, especially on the Indian Frontier, is, however, dimished alkalinity, which Wright has shown to be a frequent cause of scurvy. It must, therefore, be borne in mind that a condition resembling ordinary dysentery may be simply a variety of scurvy, and it may be well, therefore, to test the alkalinity of the blood by the method advised by Wright in all cases of dysentery in which the origin is obscure. Recently, in Somaliland, a succession of cases diagnosed dysentery were found by Lieutenant Barnardo, I.M.S., to be due to "acid intoxication," and were relieved by antiscorbutic treatment. Leishman states that 10 grains of lactate of sodium three times daily rapidly cures all conditions due to diminished alkalinity.

The cases of dysentery one occasionally comes across in Indian practice, in which native *hakims* are successful by giving abundance of fresh fruit after English remedies have failed, are, of course, scorbutic ones, so the recognition of this indication of treatment is very important.

The patient's strength must be maintained by suitable diet, as indicated above, and the administration of stimulants in some cases, but not as a matter of routine. Burgundy and Bordeaux are largely used by Continental physicians practising in the tropics, but the custom of most British physicians is to prescribe brandy or champagne in the comparatively rare cases in which alcohol is necessary. "Ether and caffeine hypodermically and saline injections have been employed with success in cases in which life appeared to be endangered by hæmorrhage and anæmia with prostration and collapse." Sparteine has also been used with success. After the very acute stage is over and when the appetite is returning the patient may be given a fairly liberal dietary. Egg and milk flavoured with nutmeg is an agreeable and nutritious food. Pounded sweetbread, chicken or mutton, may be given, with strong soups, and the many varieties of bland farinaceous food of which rice and bread are the types. During convalescence, all indigestible articles of diet should be rigidly excluded, but abundant light nutritious food allowed, and the appetite encouraged by the administration of the various bitter tonics, such as cinchona, gentian, and nux vomica. It should be constantly before the physician's mind that, although the intestinal flux may have ceased, there is a raw ulcerated surface in the bowel which must take weeks to heal; and therefore when dysentery is diagnosed all exercise should be interdicted for at least a month after the subsidence of active symptoms.

As a rule, in this variety of disease we have only to treat an acute condition, but in the rare chronic cases which occasionally come under our treatment the best method is lavage, as drugs *per os* appear to have little effect.

The treatment of chronic dysentery by rectal injections was introduced by Hare of Edinburgh, and first used in England by Stephen Mackenzie, of the London Hospital. It has been most efficacious in many cases in my own practice, and is best given in the following way:—

The bowel having been cleared with a dose of castor oil, a large enema of warm water with a drachm to the pint of bicarbonate of sodium added, should first be given, and when the whole of this has escaped, from 40 to 60 ounces of a solution of nitrate of silver, half to one grain to the ounce, should be introduced by means of a long rectal tube passed slowly into the bowel as far as it will go. It is better to fill the bowel by gravitation, using an ordinary vaginal douche apparatus.

The patient should be directed to retain the injection as long as possible, and, if appearing to do good, it should be repeated twice weekly.

It is quite useless to give small injections of nitrate of silver, and we have the authority of Osler that argyria never follows its prolonged use.

The Treatment of Amœbic Dysentery.

We now turn to the treatment of amœbic dysentery, a condition which is, I consider, the cause of most chronic intestinal fluxes met with in our practice in the East. The indications requiring treatment are here again three in number: (1) To promote a restoration of the diseased mucous membrane; (2) to counteract any morbid tendency in the blood; (3) to support the patient's strength by proper diet.

In applying ourselves to the first indications for treatment, the drug on which we must pin our faith is, I think, ipecacuanha. Scheube says this drug must be regarded as having a specific effect, "a fact which does not seem as yet to have been fully acknowledged, at least as far as German text books are concerned." Manson thinks that "ipecac. and simaruba really seem to have some sort of specific action on the disease or its cause, but in what way it is impossible to say." Yeo thinks that ipecacuanha may be microbicidal and arrest the growth of the organism producing the disease, while Fayrer points out that the mortality of dysentery in India, which was 11 per cent. before its use, fell to 5 per cent. after its introduction. Ipecacuanha prepared without the emetic principle was much vaunted at one time, but its use was abandoned by most Indian practitioners before the South African War, when it was extensively used and found most unsatisfactory. I believe Day's remarkable experience of the inability of the drug to cure dysentery was due to his using this preparation, and his failure to differentiate between the bacillary and amœbic types of the disease. He reported sixty cases, in twenty-six of which he used ipecacuanha *sine* emetina and opium, with the result that nine died, and thirty-two in which he administered sulphate of magnesium with only one death. It is possible that the nine cases which died under ipecacuanha were bacillary dysentery, while the one which died under saline treatment was amœbic. Recent testimony which goes far to show the usefulness of the drug is given by Major Leonard Rogers, of the Indian Medical Service, in a paper read before the Royal Medico-Chirurgical Society and published in the June, 1907, issue of the *Practitioner*. He says: "It is just in those tropical climates where liver abscess and amœbic dysentery occur, that ipecacuanha is looked on as a specific in many cases of dysentery, while I have been informed by several medical men with experience of dysentery in countries where amœbic abscess of the liver is not seen, that the drug is useless in the dysenteries of bacterial origin with which they have to deal. Personally I look upon ipecacuanha as invaluable in the treatment of amœbic dysentery—in fact, as a specific against that disease, and in Lower Bengal, where amœbic abscess of the liver is common, I regard this drug as second only in importance to quinine itself. If this is so, it is easy to

understand how large doses of ipecacuanha (not less than 20 to 40 grains once or twice a day some twenty minutes after a dose of opium) may rapidly abort an early presuppurative amœbic hepatitis by curing the latent dysentery that produces it, although I find no recommendation of the drug in some of the standard works on tropical medicine, except when symptoms of dysentery are present." From this opinion it would appear that ipecacuanha not only *cures* amœbic dysentery but *prevents* liver abscess. My routine method of exhibiting the drug is to put the patient in bed and on milk or whey diet and administer ipecacuanha in

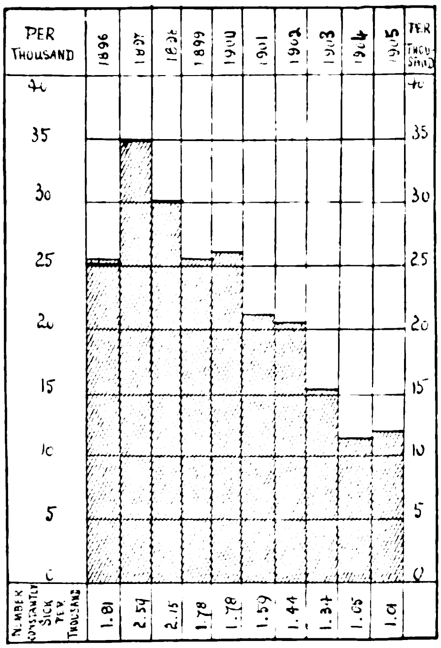

Chart showing the incidence of Dysentery per 1,000 British troops in India, and the number constantly sick from the disease per 1,000 of strength during the decennium 1896-1905.

gradually diminishing doses every night, starting with 30 or 40 grains. then proceed to give a course of very small doses of castor oil, with or without opium, three times daily, regulating the dose according to the amount of action produced. If this treatment does good I proceed to give a mixture of simaruba, with aromatics and an intestinal antiseptic, such as salol or salicylate of bismuth. These measures failing, I resort to direct topical applications. Osler and Manson are agreed that these are of the utmost value in the treatment of dysentery, but on one important point the two authorities differ. The latter insists that topical

remedies should never be applied when acute symptoms are present, whereas the former gives the technique for their use in the acute stage of the disease. Rectal injections of nitrate of silver were formerly considered to be the best form of local application in all forms of chronic dysentery, but solutions of quinine have now very largely replaced them in cases not clearly bacillary in origin. The quinine should be of the strength of 1 in 5,000 at first and gradually increased in strength till a 1 per cent. solution is reached. It should be given, after a preliminary dose of castor oil, by gravitation in the manner indicated under bacillary dysentery, and very rarely fails to give satisfactory results.

I have used it recently in some cases of very old standing, with the gratifying effect that patients who had not been passing solid fæces for years have resumed their normal habit.

Indications (2) and (3) must be combated on much the same lines as those indicated above for the bacillary type of disease. If, as unfortunately occasionally happens when the case is being treated abroad, the patient fails to get well notwithstanding most careful dieting and therapeutic efforts, the sooner he is sent to Europe the better, and in such cases after similar measures have been adopted in England, the advantages of a course of treatment at Carlsbad, or of the system of rectal douching practiced at Plombières, should be brought to the patient's notice.

In conclusion, I need scarcely add that, as with enteric fever so in dysentery, it must be constantly kept before us throughout the illness that our duty is not merely to the patient but to the community, and our first aim in all treatment should be to prevent the spread of the disease. To do this it is essential that all cases of actual dysentery, whether bacillary or amœbic, and also all suspicious cases of diarrhœa, should be promptly and efficiently isolated, and their stools, clothing and bedding carefully and scientifically disinfected by skilled persons.

If this were done in the practice of all physicians we might confidently hope for comparative immunity in the future from the fell diseases which have been the scourge of all armies in the field since the time of Agincourt, and of *all* Eastern and *many* Continental countries since the days of Charlemagne.

Reviews.

LIFE INSURANCE AND GENERAL PRACTICE. By E. M. Brockbank, M.D., F.R.C.P. London: Henry Frowde, Hodder and Stoughton, Oxford Medical Publications. Price 7s. 6d. net.

Not the least of the services which this Journal has rendered to the Corps has been to bring home to the profession and the public the fact that the old term "Army Surgeon," by which our officers have been generally designated, is very largely a misnomer, and that a large proportion do not profess to be active practitioners of surgery, but claim to be physicians *purs et simples*. When this fact comes to be more fully realised by the public, there appears to be one line of work in which the services of officers of the Corps will be eagerly sought, and that is as expert advisers to Insurance Companies.

The military physician, from the very outset of his career, spends a large proportion of his time in endeavouring to find out physical defects in apparently healthy men, while officers employed in recruiting duties do little else. It is obvious, therefore, that the duty of examining lives for insurance is work for which the special training of the military physician qualifies him in an exceptional way, and in view of these facts Dr. Brockbank's book may well claim the special attention of many officers of the Corps.

The work is divided into two parts. In the first portion the routine examination of patients is detailed at considerable length, with a view to giving practitioners, unfamiliar with the examination of proposers, the benefit of the author's wide experience. This part of the book is arranged in twelve short chapters, of which by far the best is that on the circulatory system. This chapter is full of excellent advice on the lessons to be learnt from various physical signs, and might be read with profit by even the most experienced practitioner. The special "posture murmur" to which the author refers may account for some cases sent up for further examination from our Inspection Rooms, in which an inspecting officer has detected a bruit which fails to reveal itself on further examination. The position described, in which the patient "holds the vest well up, with the shoulders thrown back," is as commonly used in military practice for routine examinations as in civilian work.

The chapter on the examination of the urino-genital organs is sufficiently full for the special purpose of the book. The author justly emphasises the importance of the heat test for albumin. It is interesting to learn that "many insurance examiners use the nitric acid test only, and do not trouble with the boiling test." Such practice, in the face of French's dictum that the "heat test is the best for albumin, and has the fewest fallacies," might well be quoted in support of Dr. T. Glover Lyon's proposal, in his presidential address to the Life Insurance Medical Officers' Association, that the Society should institute examinations, and grant certificates to practitioners desiring to become referees.

The chapter on the "Racial Expectation of Life" is good as far as it goes, and may interest officers of the Corps called upon to express an

opinion on the lives of Orientals and other foreigners. The information given might be expanded in the next edition.

In Section II. of his book Dr. Brockbank deals with "Impaired Lives." He gives us a great deal of information, collected from various sources, which might not only be read with advantage by practitioners dealing with proposals for life insurance, but by the members of Medical Boards who have to advise Departments of the State as to the value of impaired lives in a public service.

Hereditary gout and the various affections of the several "systems" of the body are well dealt with, but of special interest are the chapters on syphilis and alcohol in relation to assurance. The author gives the views of no fewer than twelve English, three Continental, and one American authority on the effect of syphilis on longevity, and sums up the widely divergent evidence very judiciously as follows: "There seems no alternative but to conclude that *syphilitic infection is a distinct prejudice to a proposer for insurance*, and that all syphilitics should only be accepted with the addition of some few years to the premium." Dr. Brockbank's views as to the use of alcohol are certainly far from being on the side of total abstinence, as he allows the temperate man half a pint of beer or two glasses of light wine twice daily, and a whisky-and-water at bedtime! This view will not meet with the approval of an important section of the profession, but will find many supporters, both in and out of the Army. Personally, I hold that the *bonâ fide* total abstainer is the best "life," and claim that total abstinence is practically the only way in which it can be certain that Parkes' standard of 1½ ounce of alcohol per diem can be permanently and *invariably* maintained under the conditions of Service life.

The author's account of the effects of the Tropics on health is brief, but very sound. He has evidently carefully considered the writings of Giles, Cantlie and Manson on the subject, and reproduced their views concisely and intelligibly; but as this is such a special branch of his subject, perhaps Dr. Brockbank will entrust the chapter to a physician with tropical experience when he brings out his next edition.

The book is well printed on good paper, and is remarkably free from typographical errors. It should find a welcome place in any medical library, and is a worthy addition to the excellent series of medical publications to which it belongs.

ROBERT J. BLACKHAM.

AN INDEX OF TREATMENT (Second Edition, 1908), by various writers, edited by Robert Hutchison, M.D., and Stansfield Collier, F.R.C.S., which has lately been published, is a book which ought to be in the library of every military hospital, if not in the possession of every officer of our Corps. Situated as we are in various parts of the world, we are frequently called upon to treat diseases and injuries of so diverse a nature that every one of us must at times wish for the very latest and most scientific opinion to assist us in the care of cases of which we may have had very little experience. The above work seems to me to be exactly the one wanted; it is of moderate compass (877 pages), and is a complete guide to treatment, excepting the management of labour and the carrying out of the more elaborate operations of surgery. Each article is written by an acknowledged authority on the subject dealt with, and only those

procedures are described which they consider the simplest and most effective. Amongst the large number of eminent teachers who are contributors we find the names of Clifford Allbutt, Rose Bradford, Clayton-Greene, Lockhart Mummery, Norman Walker, and many others equally well known.

G. J. STONEY ARCHER.

LA FEBBRE MEDITERRANEA (Setticemia del Bruce). By A. Trambusti, Professor of Pathology in the University of Palermo. Published by Alberto Reber, Palermo. 1908. 98 pp., crown octavo. Price, Lire 2.50 (2s. 1d.).

This is an admirable *résumé* of our knowledge of Malta fever, or, as Professor Trambusti prefers, "Bruce's Septicæmia." The history of the early investigations, from those of Marston in 1863 to the present day, is briefly and clearly given. This is followed by a concise account of the symptoms, diagnosis and pathology of the disease. The morphology and cultural characters of *Micrococcus melitensis* are clearly stated, and the results of animal experiments are given. Considerable space is devoted to the serum reactions, and Zammit's test for milk is described in full.

The work terminates with an appeal for the use of a new name for Malta fever, namely, "Bruce's Septicæmia" (*Setticemia del Bruce*). "By this title," writes Professor Trambusti, "we achieve two objects: first, that of indicating clearly the nature of the infection; and, secondly, that of publishing to the scientific world the name of an illustrious colleague, to whom is due a discovery of so great importance."

There is a very complete bibliography appended.

A. I. FORTESCUE.

BULLETIN DE LA SOCIÉTÉ DE PATHOLOGIE EXOTIQUE. Vol. I., No. 1, 72 pp., crown octavo. Price 13s. 4d. per annum. Paris: Masson et Compagnie, Boulevard St. Germain, 120.

We heartily welcome the first number of the organ of the Society whose aims and objects were clearly set forth in a letter from Professor A. Laveran, published in the February number of the Corps News. This periodical will form a valuable addition to current literature dealing with tropical medicine. Among the contributors we notice such well-known names as those of Laveran, Marchoux, Levaditi, Mesnil, Thiroux and Nicolle. Among the subjects treated of are those of sleeping sickness, leprosy, tropical liver, Oriental sore, cholera, Malta fever and debab. The magazine is well got up and clearly printed. Among the list of honorary members of the Société de Pathologie Exotique, which appears at the commencement of the volume, we note the names of Colonel D. Bruce, R.A.M.C., and of Major Ronald Ross, I.M.S. The number of honorary members is limited to forty.

We wish the *Bulletin* and the Société de Pathologie Exotique every success. *Vive l'entente!*

A. I. FORTESCUE.

Current Literature.

A New Method of Cultivating Trypanosomes. — In *Saikingakuzasshi*, Tokio, No. 138, for 1907, Dr. Irikura describes a new method of cultivating trypanosomes. The methods hitherto employed require blood-agar media, for the preparation of which a relatively large amount of blood is necessary, and which become useless on keeping for any length of time. Dr. Irikura has employed successfully a new medium discovered by himself. This medium is a blood-broth, easily prepared, a small amount of defibrinated rabbit's blood being added to ordinary bouillon. Into this liquid medium the trypanosomes are introduced, *e.g.*, a drop of blood from a trypanosomiasis-rat, and a considerable growth soon occurs. Cattle, horse or guinea-pig blood may also be used; ½ to 2 cc. of blood should be added to 10 cc. of bouillon. The culture is brought to 25° or 30° C., and the broth will show an abundant growth three days after inoculation. The author recommends the pouring of liquid paraffin on to the surface of the medium to keep the latter sterile and prevent the growth of saprophytes. By this means also the life of the trypanosomes is prolonged. The author mentions that Miyasima, working inpendantly, has devised a similar medium, thus confirming Irikura's work. A. I. FORTESCUE.

The Spontaneous Decomposition of Atoxyl. — In the *Deutsche Medizinische Wochenschrift* for January 30, 1908, Dr. W. L. Yakimoff records some interesting facts with regard to the decomposition of solutions of atoxyl. He finds that weak solutions (1 per cent. to 2 per cent.), if kept in the dark, remain unaltered for a fairly long time. Stronger solutions (10 per cent.) likewise remain unaltered in the absence of light, but require frequently to be made up to strength. Fresh solutions are always to be preferred. The stock solution should not be sterilised, but made up with cold sterile water. Immediately before use the requisite quantity of stock solution should be boiled for one or two minutes in a test tube over an open flame. No decomposition need be feared in the short interval between boiling and injection. The slightest suspicion of yellow colouration in the stock solution necessitates its being prepared afresh. The solution should not be rendered alkaline.

According to the author, there are two important factors in atoxyl-intoxication. The first is the source of the preparation; the French drug being harmless in gramme doses, while the German is dangerous in quantities of over 0·4 gramme. The second factor is spontaneous decomposition, which depends on the method of preparing and storing the solution. A. I. FORTESCUE.

Prevention of Venereal Disease in the Austrian Army. — The *Wiener Med. Wochenschrift*, No. 49, 1907, p. 2,325, publishes an account of experiments made by the Austro-Hungarian War Office in the prevention of venereal diseases since 1904.

A solution of 3 per cent. albargin (albargin 30, glycerine 10, distilled

water 900 parts) is supplied for urethral injections, and a 1 in 1,000 sublimate solution for ablution. Medical officers took much interest in the experiments, and in some cases effected a decrease of 62 per cent. in the cases of venereal disease in their units.

The result of the experiments has been to induce the War Office to introduce the system of prevention generally into the army, by an order of May 1, 1907. Men are not, however, to be compelled to use the preventives and punished for not using them, but they are to have lectures, &c., on the advantage of using them.

In the neighbourhood of the entrance to barracks, or in the regimental sick room, a space is to be screened or curtained off with the necessary equipment, solutions, &c., and the men are to be instructed in their use. A register is to be kept, and the men are to enter their names, and the day and hour of using the preventives. In every case of venereal disease a note is to be made whether the man used the preventives or not; and at the end of the year a general report on the results will be submitted.

W. G. M.

Researches in the Treatment of Trypanosomiasis.—A. Laveran and A. Thiroux contribute a paper on this subject to *Annales de l'Institut Pasteur*, February, 1908. Lingard first recommended the employment of arsenic in the treatment of a trypanosomiasis—Indian surra. It is to be noted that Lingard recommended it to be followed by a course of the double iodide of arsenic and mercury. One knows further that the association of mercury and arsenic has been recognised during the last few years, and that in the hands of different observers it has given good results in the treatment of trypanosomiasis.

D. Bruce, in Zululand, used the arsenite of soda in the treatment of nagana; and he has stated that whilst this drug prolongs the life of infected animals, yet it never cured.

Since 1904, one of the authors has pointed out the efficacy of arsenious acid in rats infected with *Trypanosoma gambiense*, and has showed that the effective dose was 0·1 milligramme arsenious acid per 20 grammes of the animal, *e.g.*, 1 milligramme for a rat weighing 200 grammes. The arsenious acid was used in the form of arsenite of soda.

Borden, Greig and Gray, Dutton, Todd and Christy have either employed arsenious acid or the arsenite of soda in the treatment of human trypanosomiasis. Borden gave his patients hypodermic injections of Fowler's solution, diluted 50 per cent. These injections represented 10 to 15 milligrammes of arsenious acid, and were well borne. The number of trypanosomes were noticeably diminished following these injections, but the parasites did not definitely disappear. Greig and Gray have given adult negroes suffering from sleeping sickness, 10 to 20 milligrammes of arsenious acid; they have stated that amelioration followed this treatment. The condition of a patient submitted by Dutton, Todd and Christy to arsenical treatment was greatly improved. The effect of arsenic on the trypanosomes is remarkable; one can easily make the parasites disappear from the general circulation in twenty-four to forty-eight hours by this drug. Unfortunately, the trypanosomes almost always reappear, even when the arsenical treatment is prolonged. One has therefore been driven to search for more efficacious remedies.

Ehrlich and Shiga have shown that a red aniline dye of the benzo-

purpurin series, to which they have given the name of "Trypanroth," has a very marked effect on trypanosomes, and they have succeeded in curing several mice infected with Mal de Caderas by means of this drug. The dye employed by itself is found to be less efficacious in the treatment of other trypanosomiases, or even in the treatment of Mal de Caderas, in animals other than mice.

One of the authors has obtained the best results in the treatment of several forms of trypanosomiasis by associating arsenical medication with that of trypanroth. Different animals (rats, mice, dogs, monkeys) infected with *T. evansi*, *T. gambiense*, or *T. equiperdum*, have been cured by means of this mixed treatment.

Wendelstadt and Fellmer discovered "brilliant-green," and have obtained some successes in the treatment of trypanosomiasis by the association of brilliant-green and atoxyl. Mesnil, Nicolle and Aubert have experimented with animals suffering from different trypanosomiases with several of the benzidine dyes. One of these dyes was shown to be particularly active. Ehrlich has stated that the chlorhydrate of parafuchsin was as efficacious in the case of certain trypanosomiases of animals.

Unfortunately, the employment of dyes presents inconveniences; the attempts to treat human trypanosomiasis, the cure of which is the main object to be sought for by these medications, have not been favourable.

In 1905, W. Thomas, of the Liverpool School of Tropical Medicine, called attention to the properties of atoxyl or the anilarsinate of soda. The activity of atoxyl in the treatment of trypanosomiasis is remarkable. This has been well shown by the researches of Ayres Kopke, Borden and Rodhain, Koch, Von Campenhout, S. Martin, Thiroux and D'Anfreville, Breinl and Todd, and Hollebeke, on the use of atoxyl in the treatment of human trypanosomiasis. The trypanosomes disappear rapidly from the blood under the influence of atoxyl, the hypertrophied lymphatic glands return to their normal size, the nervous symptoms clear up, the general health is improved, and one can readily understand why the first observers who employed this drug believed in its efficacy. A prolonged experience has shown that if atoxyl should produce a remarkable amelioration in the general health of the patients, it very rarely cures, and intensive treatment carried on for a year, or even more, does not suffice to stave off relapses. Ayres Kopke has cited the case of a patient treated for fifteen months, during which he received thirty-three subcutaneous injections of atoxyl (of 1 to 1·5 grammes each), who still had trypanosomes in his cerebro-spinal fluid, and who died after a series of epileptiform attacks.

Ehrlich has shown that in animals treated by various drugs, and notably by atoxyl, one obtains races of trypanosomes which resist (*i.e.*, are proof against) these drugs. One race of trypanosomes was still atoxyl-proof after the one hundred and third passage! This trait is of great interest from the point of view of the therapeutic treatment of trypanosomiasis; it explains both the ill-success of prolonged medications when only one form of drug is used, and the success obtained by combining two or more drugs in the treatment. Further, it has been shown that atoxyl is liable to cause serious accidents, in particular loss of vision from optic neuritis.

It would seem evident to-day that the introduction of atoxyl into the

therapeutics of trypanosomiasis, if useful—as it has been—has not solved the problem completely, and thus the search for drugs more efficacious and less dangerous is required. Moore, Nierenstein and Todd have tried a mixed treatment by atoxyl and mercury, which has given them good results in the treatment of nagana (experimental) in rats. The mercury was employed in the form of the bichloride (10 per cent. solution), hypodermically injected, or in the form of Donovan's solution (iodide of mercury, 1 per cent., and iodide of arsenic, 1 per cent.). Rats infected with *T. brucei* received 0·5 cc. of the 5 per cent. solution of atoxyl, and, four days later, 2 cc. of a 1 per cent. solution of the bichloride. Out of twenty-five rats so treated, thirteen have survived. All the rest treated by atoxyl alone died. It is not easy to understand how the salts of mercury, which, employed alone, have no action on the trypanosomes, become active when employed with atoxyl; but this difficulty detracts nothing from the interest attaching to the observations of Moore, Nierenstein and Todd. If a drug is effective, that is the chief point; there is time enough afterwards to explain why it should be so.

Recently, Loeffler and Ruhs have discarded atoxyl in favour of arsenious acid. These observers have experimented with nagana-infected guinea-pigs. The arsenious acid in a 10 per cent. solution was injected into the peritoneum, or, better, introduced by the mouth. The best method of administration consisted in giving efficacious doses (6 milligrammes per kilogramme of animal) at five-day intervals; five doses, and occasionally three doses, sufficed to obtain a cure. It should thus be possible to employ arsenious acid as a preventive of trypanosomiasis, in the same way as one uses quinine as a preventive for malaria. The authors thought that it would be useful to repeat the experiments of Moore, Nierenstein and Todd, as well as those of Loeffler and Ruhs. They have besides made researches on the utilisation of trisulphide of arsenic, on the iodide of arsenic, and on arsenious acid associated with atoxyl, in the treatment of trypanosomiasis. The following questions were studied in succession:—

(1) The value of the mixed treatment by atoxyl and the salts of mercury; (2) the curative and prophylactic value of arsenious acid; (3) the mixed treatment by atoxyl and trisulphide of arsenic; (4) the mixed treatment by atoxyl and the iodide of arsenic; (5) the mixed treatment by atoxyl and arsenious acid. The experiments have been carried out on guinea-pigs or on rats infected with *T. evansi*, occasionally with other trypanosomes. The treatment was not commenced until the trypanosomes were numerous, or sufficiently numerous, in the blood.

Conclusions from Experiments.—(1) The mixed treatment by atoxyl and the salts of mercury (biniodide or sublimate) has given indifferent results (three cures out of twelve guinea-pigs) in guinea-pigs infected with trypanosomes (surra de Maurice); better results, however, than those obtained by atoxyl alone.

(2) No guinea-pig treated by atoxyl alone was cured.

(3) Arsenious acid employed alone has given variable results according to the mode of administration. Guinea-pigs treated by ingestion of arsenious acid every fifth day for five doses, in the method recommended by Loeffler and Ruhs, either died or have had relapses; three guinea-pigs treated with arsenious acid every second day with increasing doses

(five doses) were cured. Intraperitoneal injections of the arsenious acid solution (2 to 3 milligrammes of arsenious acid, according to weight of guinea-pig: 2 milligrammes for a guinea-pig weighing 350 to 450 grammes, 3 milligrammes for a guinea-pig of 675 grammes) have given bad results.

(4) Arsenious acid, even when given in large or repeated doses, has shown no activity in the prevention of trypanosomiasis in the guinea-pig.

(5) The trisulphide of arsenic, employed alone in a colloidal solution (by hypodermic injection or by ingestion), or by ingestion in the form of pills, has given six cures in thirteen guinea-pigs so treated. The orpiment, in pills (one to four pills of 4 milligrammes each; five pills for a 500 gramme guinea-pig; five doses with a two- or five-day interval between doses), has given the most satisfactory results (two cures in three guinea-pigs).

(6) The alternative hypodermic injections of atoxyl and the trisulphide of arsenic (colloidal solutions hypodermically, or orpiment pills) have given the greatest number of cures. Out of seven guinea-pigs treated by this method, there were seven cures. It is effective often with guinea-pigs which, treated previously by other methods, have had relapses, and so were in a bad state from a treatment point of view. The drugs were given alternately, at twenty-four to forty-eight hour intervals: the atoxyl in 2-centigramme doses (five doses), and the orpiment in 9 to 18 milligramme doses (five doses) for guinea-pigs weighing about 500 grammes. The ingestion method of administering the orpiment is preferable to the hypodermic injections of the colloidal solution, the injections often producing local damage.

(7) The mixed treatment by atoxyl hypodermically, and the iodide of arsenic either hypodermically or by ingestion in pill form, gave three cures out of eight guinea-pigs treated, results greatly inferior to those of the atoxyl and orpiment.

(8) The mixed treatment by alternate dosage, at forty-eight hour intervals, of atoxyl hypodermically, and arsenious acid by the mouth (atoxyl 1·5 to 2 centigrammes, and arsenious acid 2 to 4 milligrammes; five doses of each) has succeeded twice in three attempts; but the toxicity of arsenious acid, efficient doses of which border on the toxic, constitute a serious inconvenience in this method.

The authors conclude by saying that whilst it would be premature on their part to say that the combined atoxyl and orpiment treatment as mentioned under (6) would cure sleeping sickness, especially as their experiments were not carried out with *T. gambiense*, yet they would recommend its trial in the disease. The treatment, they state, is not difficult to carry out, and would be less dangerous than that by atoxyl alone, as it would be possible to obtain a cure without employing very large and frequently repeated doses of the latter drug. The question of dosage in man by orpiment would require working out. They suggest that it would be possible to start in an adult with 3 centigrammes, in pills, and to push the dose fairly rapidly up to 10 to 15 centigrammes. Several patients, they state, are already undergoing the mixed atoxyl and orpiment treatment for sleeping sickness. For details of experiments see the original paper.

H. R. Bateman.

Malta Fever in Algeria.—In the *Bulletin de la Société de Pathologie Exotique* for January 22nd, 1908, Dr. Edmond Sargent contributes a preliminary note on the occurrence of Malta fever in Algeria. From April to November, 1907, a Committee consisting of Drs. Gillot, Lemaire and Boiries investigated the question of the occurrence of Malta fever in goats and other domestic animals; and, further, the results of experimental infection in monkeys. As regards goats, Zammit's lacto reaction was positive in only 4 per cent. cases examined, and *Micrococcus melitensis* was never isolated from the milk. All the goats providing milk in the commune of Alger, 609 in all, were examined. Most of the goats were of the Maltese breed. At Kléber and Arzen, in the commune of Oran, the lacto-reaction was positive in 2·95 per cent. cases, while culture tests were always negative. Three hundred and thirty-eight milch goats were examined in Oran, chiefly Spanish or native, but a few of those on the coast were Maltese animals imported from Gibraltar. Malta fever is evidently not nearly so prevalent among goats in Algeria as in Malta, and the percentage affected appears to be proportional to the number of Maltese goats in a flock. Further, an Algerian goat subcutaneously inoculated with human *M. melitensis*, gave the lacto reaction during twenty-three days only, and the culture test not at all.

In 1906-07 a serious outbreak of Malta fever occurred in the village of Kléber, and eight of the inhabitants still gave, at the time of writing, a positive serum reaction. Of forty-one farm animals—horses, mules, donkeys, dogs, &c.—examined, six gave the serum reaction. Of the eight human cases only one would admit that he drank unboiled goat's milk; two asserted that they very rarely took goat's milk, and then only boiled; while two others stoutly denied having ever swallowed any goat's milk. Two of the Malta fever patients, who said they never drank fresh milk, were labourers at a farm at which there was a mule which gave a positive serum reaction. They groomed this mule every day, and were never in contact with goats. Since *M. melitensis* is so freely excreted in the urine of infected animals, it is quite possible that these labourers may have been infected by contact with the mule, or with its harness or stable litter.

A number of experiments were made with monkeys with the object of testing the various possible modes of contamination, inoculation, ingestion, inhalation, &c. The committee do not appear to have made many experiments, but conclude that ingestion is not an easier mode of infection than the others.

On account of the stringent sanitary precautions undertaken by the Government of Malta with the object of supervising and getting rid of infected goats, there has been a considerable exportation of these animals from Malta to Algeria and Tunis. The Committee are strongly of opinion that the importation of Maltese goats should be confined to the ports of Alger (Algiers) and Tunis, and that only those animals should be passed by the public health authorities which gave negative results when tested by serum agglutination, lacto reaction or bacteriological culture.

A. I. FORTESCUE.

Correspondence.

WHEN SHOULD MERCURY BE GIVEN FOR SYPHILIS?

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I think all are agreed that, immediately syphilis is diagnosed, the sooner mercury is administered the better for the patient. I also believe that the majority of our officers hold that it is wiser to make absolutely certain that their patients have undoubted syphilis, before condemning them to at least a two years' course of mercurial treatment.

One knows the stock argument, that cases in which the administration of the drug is delayed until the appearance of secondary symptoms, are liable to suffer from disease of the nervous system later on; but this theory would be exceedingly difficult to prove. As regards the possibility of diagnosing syphilis from the appearance of the sore, I would venture to state that the typical Hunterian chancre is very seldom seen nowadays, and that secondary symptoms more often follow what was apparently a non-infective sore.

The difficulty of diagnosis based on the appearance of the sore can be supported to some extent by the records on medical history sheets which one used to see a few years ago, where many men had half a dozen entries for "Syph. Prim." What is badly wanted is some easy and reliable method of discovering the *Spirochæta pallida*. If this were attained, one would be in a position to make a correct diagnosis at once, and to start mercurial treatment earlier than is possible at present.

As regards the popularising of the continuous method of treatment which was introduced several years ago, there is no doubt of the value of the waiting policy. Once the men have seen the initial rash of syphilis, and are certain they have the disease, there is no attempt at shirking their treatment, and many men who have to be transferred to the Reserve before the expiration of their two years' course will be more willing to go on with it voluntarily.

I am, &c.,

F. J. W. PORTER,
Major, R.A.M.C.

Colchester,
February 14th, 1908.

REGISTRATION OF LANGUAGE PROFICIENCY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—With reference to the letter of "J. R. W." in the February number of the Journal, may I be permitted to say a few words as to a possible, and perhaps adequate, reason for the reluctance of officers of the Royal Army Medical Corps to qualify for proficiency in foreign languages?

Paragraph 17 of the official Language Regulations reads as follows: "All officers may enter for the interpretership examinations, and their names will be recorded if they 'pass' (50 per cent. marks) or qualify as 'interpreters' (80 per cent. marks), *but grants of money will only be issued to those who qualify under paragraphs* 3—9." If we now refer to "paragraphs 3—9" we read (paragraph 5), "an officer of the Regular Forces of the *Cavalry, Royal Artillery, Royal Engineers, Infantry, West India Regiment or Army Service Corps*, who has spent at least two months (not necessarily in one continuous period) in a foreign country for the purpose of learning its language, ... and who subsequently passes the interpreter's test (80 per cent.), will receive a fixed grant of money to assist him in defraying the expenses he has incurred in going abroad." Then follows a list of rewards of from £25 to £50, given for proficiency in each of fifteen European languages.

It will be observed from the above extracts that all officers of the Royal Army Medical Corps are definitely excluded from any participation in the official rewards for language proficiency. They can never hope to recoup themselves, even to a limited extent, for the considerable expense entailed in acquiring a working knowledge of any modern language. Yet it is obvious that foreign languages must be of great advantage to a medical officer. On active service he is constantly called upon to treat the wounded of the enemy, and to work in collaboration with foreign army surgeons. Further, the rapid advances being made abroad in every branch of science render it of the utmost importance that he should be in a position to keep himself abreast of the times.

I am, &c.,

Royal Army Medical College, A. IRVINE FORTESCUE,
March 4th, 1908. *Lieutenant, R.A.M.C.*

BATHS AND BATHING IN JAPAN (NET-SU-NO-YU: A JAPANESE MINERAL WATER).

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In my paper "Baths and Bathing in Japan," which appeared in the Journal for last July, I gave from Japanese sources the temperature and chemical analysis of five of the chief springs at Kusatsu.

I was informed at the time that this analysis was made more than twenty years ago and was the only one available. As this health resort has obtained a very considerable reputation in the Far East, and is likely to be still better known, I have had samples of the water from the chief spring, known as the *Net-su-no-yu*, carefully collected and sent to London for analysis, and now forward a copy of the Report of Messrs. P. V. and F. H. Dupré, dated January 1st, 1908. It will be noticed that arsenic is not found in the water.

As the quoted authorities seem to differ on this and other points, I should be much obliged if you can find space for this Report.

I am, &c.,

K. BRUCE BARNETT,
Major, R.A.M.C.

Grand Hotel, Dover,
March 3rd, 1908.

[*Copy.*]

Dr. A. DUPRÉ, F.R.S.
Analytical and Consulting Chemist.

2, *Edinburgh Mansions,*
Howick Place, S.W.
January 1st, 1908.

Report on a sample of Japanese mineral water received from Messrs. Holt and Co., December, 1907.

Sample contained in four pint bottles labelled "Yebishu Dai Nippon Brewery Co., Ltd., Tokio, Japan." Also a Japanese inscription.

The analytical results are as follows:—

	Parts per 100,000
Sulphuric acid (SO_4) combined	56·5
,, ,, ,, free	288·0
Chlorine (Cl)	73·7
Silica (SiO_2)	19·3
Iron (Fe)	13·3
Aluminium (Al)	16·8
Calcium (Ca)	13·6
Magnesium (Mg)	4·0
Alkali metals (K & Na)	11·3
Organic matter	3·0

The water, besides containing a large amount of free sulphuric acid, contains a trace of nitric acid, probably combined, and also a trace of boric acid.

(*Signed*) P. V. DUPRÉ.
F. H. DUPRÉ.

A FORGOTTEN ANTHROPOLOGIST.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The prefatory remarks of Professor Arthur Thomson to his memoir of Surgeon-Major George Williamson, A.M.D., in the March number of the Journal, suggests my sending to you the following record, which I find among my notes on the services of Army medical officers:—

George Williamson, L.R.C.S.Edin., 1838; M.D. Univ. Edin., 1840;

Assistant Surgeon, Army, March 26th, 1841; Staff-Surgeon, 2nd Class, July 13th, 1847; Surgeon-Major, March 26th, 1861.

From 1841 to 1849 he was stationed at Chatham, and was appointed Surgeon, 75th Regiment, *v.* Gray. Exchanged March 30th, 1849 (75th Regiment went to Bengal in May, 1849), Surgeon, 22nd Regiment, *v.* Coghlan. Exchanged September 15th, 1854 (22nd Regiment returned from India in July, 1855). From 22nd Foot to Staff, December 7th, 1855; 1856, Turkey, to July, when to Chatham until 1860; 1860-61, Cape; 1862, Stirling and London; 1863, Portsmouth; Surgeon, 64th Regiment, May 5th, 1863, Headquarters, Colchester. Williamson died at Brighton, October 31st, 1865.

A reference is made in the *Lancet* of February 20th, 1864, to his "Military Surgery" (J. and A. Churchill and Sons).

I am, &c.,

Trowbridge,
March 19th, 1908.

J. P. H. BOILEAU,
Lieutenant-Colonel, A.M.S. (Retired).

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Royal Army Medical Corps.

Original Communications.

HOSPITAL SHIPS.[1]

By FLEET-SURGEON E. B. PICKTHORN, R.N.,

IN dealing with the subject of hospital ships, I propose first of all to give a few extracts from past experiences, which I hope will prove of interest, and which I think bring forward points that are worth bearing in mind.

The French claim to have been the first to utilise a sea-going ship for hospital purposes. Towards the end of the seventeenth century a recommendation was made to the French naval authorities that one hospital ship should be attached to every ten ships of the line, and that such should be dedicated specially and solely for the use of the sick and wounded. The decks were to be high, the portholes large, and the gun batteries entirely disencumbered, in order that the beds destined for the sick might be placed there. The report goes on to say that besides the crew necessary for navigating the vessel, there must embark on each hospital ship a chaplain, a paymaster, a capable and experienced surgeon, two assistant-surgeons, a senior physician, two assistant-physicians, two wardmasters, two washermen, a baker and a cook. The ship must be provided with instruments and other articles necessary for the practice of medicine and

[1] Paper read before the United Services Medical Society on March 12, 1908, at the Royal Army Medical College, Millbank, S.W.; Inspector-General Sir Herbert M. Ellis, K.C.B., K.H.P., F.R.C.S., Director-General of the Medical Department of the Royal Navy, in the chair.

surgery; also with old linen, sheets and blankets for 100 beds, and, generally, all that might be useful in preparing nourishment for the sick and wounded.

In June, 1690, there was an opportunity of putting these recommendations to the test, when the fleet left the roadstead of Brest to take part in the battle of Beachy Head. Ample provision for the reception of sick and wounded on shore had rapidly been made at Brest, Dunkirk and Calais. The hospital ships formed, with the freight ships, a line on the right of the fleet, ready to play the part assigned to them. It is recorded that sixty wounded were landed from hospital ships on the northern coast, and eighty-one on the western, not a large number, when it is considered that there were 811 wounded and 712 sick. The test cannot be said to have had a fair trial, as many of the fighting ships, in disobedience to orders, returned to the coast of France, making as an excuse the number of sick and wounded that had to be treated. The difficulty of transporting the wounded appears to have been the reason for not making more use of the hospital ships. This first experience must not be too harshly criticised, when it is remembered that all the vessels were sailing ships, and that probably the fighting ships had no serviceable boats left. The hoisting out of large boats also required considerable time and much labour. A writer of the period attributes the ill-health of the ships' companies in general to the bad water, unwholesome bread, and presence of beasts on the orlop deck; and these conditions applied equally to the hospital ships. A death-rate of fifteen out of sixty wounded that were treated on board at first, and subsequently landed, was considered a satisfactory result.

Sir Gilbert Blane, when serving in the West Indies in 1741, recommended the use of hospital ships to relieve the large percentage of sick, then about 14 per cent.; while, in our naval records of the eighteenth century, there are frequent allusions to hospital ships, but these were stationary hulks, generally used only in times of epidemics. They were, as a rule, anchored well away from the remainder of the shipping in a harbour, and references to them are generally made in connection with yellow fever epidemics in the West Indies. We nowadays have examples of these in the small-pox ships at Purfleet; and the "Dreadnought" served as a hospital ship for seamen of the Merchant Service for forty-nine years, until, in 1870, the present Seaman's Hospital at Greenwich was established. These ships have been

generally condemned, especially when used for infectious cases. They are badly lighted, difficult to keep warm in cold weather, the risk of fire is great, a good supply of fresh water is difficult to maintain, and ventilation by purely natural means has been found to be inefficient.

In 1873 H.M.S. "Victor Emmanuel," a wooden screw steam line-of-battleship, then about eighteen years old, was converted into a hospital ship for use on the West Coast of Africa. The work of conversion took over two months to accomplish, and when completed afforded accommodation for six officers and 142 men in cots, and about 60 convalescents in hammocks. The principal Medical Officer, Major Bleckley, comments thus on this accommodation: "With 142 cots occupied, the space allowed to each patient would only be 333·58 cubic feet, and the superficial area 36·9 square feet; but the number of beds actually available for occupation, under ordinary circumstances, was reduced to 120. If all the cots had been occupied at one time and the proportion of severely wounded or dysenteric cases had been great, extreme care would undoubtedly have been required to maintain effective ventilation and purity of the hospital air." The "Victor Emmanuel" was employed as a stationary hospital ship at Cape Coast Castle for two months, and all the worst cases, mostly dysentery and malarial fever, were sent on board, in order to relieve the base hospitals. Embarkation of sick and wounded took place in surf boats, and occupied from twenty to forty minutes, according to whether, after getting through the surf, the boats were towed by a steamboat or paddled all the way. At the end of two months the "Victor Emmanuel" left for England with 167 invalids on board, and the beneficial effect of the voyage on the health of the men was very soon apparent. As regards defects, the Principal Medical Officer points out that the accommodation for sick or wounded officers was insufficient, only six cabins being set apart for this purpose. Another mistake was the screening off of a portion of the hospital deck to protect cases of tropical fevers when approaching colder climates; on this he remarks that a clean sweep of deck fore and aft is most essential.

Of course, such a proceeding as equipping a man-of-war, with a naval crew of 270, such as the "Victor Emmanuel" had, as a hospital ship, would nowadays be out of the question, owing to the restrictions of the Hague Convention, and I believe this to have been the last occasion on which a fighting ship was thus utilised. Ever since this date our mercantile marine has been

called upon whenever the necessity for providing a hospital ship has arisen.

In 1885 the P. & O. Company's steamship "Ganges" was selected to act as a hospital ship to the Suakin expeditionary force, and the Principal Medical Officer, Brigade-Surgeon G. C. Gribbon, states in his report: "So rapidly pushed on were the requisite structural alterations and additions, including the removal of nearly all the first and second-class passenger cabins and the insertion of additional ventilating shafts and other work, that she was ready for sea twelve days after the date of her being chartered by Government. This is a great contrast to the two months occupied in fitting out the "Victor Emmanuel." Accommodation was provided for sixteen officers, eighty-one men in bed, and sixty convalescents: this latter number could be increased by utilising hammocks instead of cots. At sea, an infectious ward was provided by using the horse-boat, which could be roofed in and was slung just abaft the hurricane deck, affording accommodation for from four to six men, who were thus effectually isolated. One case of small-pox and two hospital orderlies were so isolated on one voyage home. The ship was employed as a stationary ship for ten weeks, during which period 784 patients were treated, 105 of these being cases of wounds. No major operations had to be performed on board, the surgical procedures necessary being for secondary hæmorrhage, and for extraction of bullets or fragments of bone. It was found that whilst lying at anchor in sea water at a temperature of 90° F., the wards on the lower deck became uncomfortably hot, and a short trip at sea was recommended, but the sudden end of the expedition rendered this step unnecessary. A steam launch was utilised to give convalescents a trip out to sea; it held forty patients, and served as a valuable adjunct in the treatment. The horse-boat, a large flat-bottomed craft, was used for the embarkation of sick and wounded. She was fitted so that cots could be slung on bars, and was able to accommodate twenty invalids at a time.

Within the last ten years, hospital ships have been used to a much greater extent, and all Powers seem agreed that they must be recognised now as a necessary part of a war equipment. This is seen by the adaptation to maritime warfare, by the Hague Conference of 1899, of the principles of the Geneva Convention of 1864, It is there laid down that ships constructed or assigned by States specially and solely for the purpose of assisting wounded, sick or shipwrecked, shall be free from capture, provided their names have

been communicated to the belligerent powers. This also refers to hospital ships provided by private individuals or recognised relief societies. Such vessels are to assist the wounded, sick, or shipwrecked of the belligerents, independently of their nationality, and must not be used for any military purpose. They are to be specially painted and must fly a distinguishing flag both for their own protection and for recognition when succour is needed. They must not hamper the movements of the combatants, and either belligerent can direct their course or order them off. After an engagement they will act at their own risk and peril. The most important addition of the 1907 Conference has been a decision that the presence of wireless telegraphy apparatus on board is not a sufficient reason for withdrawing protection.

There appears to be no place for a hospital ship during an engagement but to keep well out of the way, ready to intervene immediately after the cessation of an action. To follow in the wake of a fleet might afford useful information to an enemy, or cause a suspicion of spying, and the belligerent might exercise his right to direct her course. As a fleet nowadays, when ready for action, spreads over some miles of ocean, and 8,000 yards is considered quite an ordinary range at which to commence hostilities, a hospital ship would have to follow at some considerable distance to be out of danger, and the tactics of the fleet might easily bring her into the midst of hostilities. A hospital ship, therefore, will probably only be utilised in rescuing shipwrecked crews, when a burning or otherwise injured ship is left isolated, or when a disabled ship retreats beyond the line of fire. With the installation of wireless telegraphy, a hospital ship could easily be summoned when required, so that her position during action should be such as will insure her safety and in no way compromise her neutrality. The work of rescuing men from sinking or burning ships must be left to the more fortunate vessels of the fleet.

Experience of hospital ships has latterly been in connection with adapted commerce ships. Japan constructed two ships with a view to their future conversion on an emergency. They were built on the advice of a technical committee, and utilised as ordinary passenger and freight ships in peace time, with the proviso that they were only to be employed in home waters, so as to be handy when required. The company running these ships was given the plans for conversion, and had to undertake the work, in peace time in five weeks, that is, thirty working days, and in war time in one week.

Though the great utility of these adapted ships has been recognised, there is a general consensus of opinion that specially constructed ships should be provided for permanent hospital use. When large numbers of seriously wounded men have to be dealt with, as is likely to occur after a naval action, where the cases will be those of shell wounds and particularly liable to sepsis, it is probable that the adapted ship would not prove suitable. Unfortunately, the experiences of Japan in her late war have not helped us in this matter, as the distances of the scenes of action from her home ports were so short that nothing beyond a transport was necessary, and some of their hospital ships were taken up with the intention of never detaining wounded men on board for a longer period than three days.

The uses to which a hospital ship may be put appear to be (1) as a stationary hospital ship; (2) as a ship for the transport of sick and wounded; (3) as an ambulance ship; (4) as a ship to accompany a fleet, and in which medical and surgical treatment can be undertaken for as long a period as requisite.

The stationary ship appears to be chiefly a military requirement, and has two special advantages over emergency hospitals, in that a supply of good fresh water can be depended upon, and disposal of sewage is an easy matter. Then again, although called stationary, there is no reason why such a ship should not be capable of going to sea, and in tropical climates this might be a great aid in treatment. The United States hospital ship "Relief" was so employed for a time at Manila.

The transport for sick and wounded would be required for such patients as had already undergone treatment in base hospitals or stationary hospital ships.

Ambulance ships would act as attendants on fleets in action to take the wounded back to base hospitals, and only cases of urgency would be treated on board as far as operative measures were concerned. These ships should be fitted for not more than 100 patients; this would much facilitate transport, as the supply of boats would be greater, a most important point after an action, as transport of wounded will have to be carried out almost entirely by boats. The Japanese found that to bring a hospital ship alongside a man-of-war was very difficult, and prolonged the work of transhipment. Any device to supplement boats should be thoroughly tested in peace time. In all probability, after a naval action there would be a number of cases in which major operations would be urgently necessary, and which it would be in-

advisable to move about more than could be helped. For these the hospital ships accompanying the fleet will be necessary.

It would not be possible to maintain in peace time a sufficient number of specially constructed ships to fulfil all demands in war time, consequently we must still be largely dependent on converted ships. The balance of opinion is in favour of constructing vessels with a view to conversion, as against conversion of any ordinary ship in an emergency; the alterations can thus be carried out more quickly, and it seems very desirable that we should make some such preparation. Some of our shipping lines which deal specially with emigrant service, might be induced to construct ships that would prove suitable. I select emigrant ships, as they generally possess good clear decks, there is no ornamentation about them, and they should not be required in war time. It is important that no cargo ship should be thought of in this connection. The transports for sick and wounded, and ambulance ships, could be supplied from converted ships; stationary ships, and ships to accompany a fleet should, if possible, be specially constructed.

As regards a specially constructed ship, the following appear to be the most important points to which attention should be directed :—

(1) A ship to accommodate 200 sick or wounded, in the proportion of 20 officers and 180 men. A staff of 6 medical officers, 35 male nurses, and 5 nursing sisters, with a crew of about 100 officers and men, should be sufficient.

(2) As regards size, a gross tonnage of from 5,000 to 6,000 tons, length 450 feet, with a beam of at least 40 feet, should afford ample accommodation. The vessel should be fitted with bilge keels, and propelled by turbines with a speed of not more than 16 knots. This should ensure a good steady craft.

(3) She should be fitted to burn oil fuel. The advantages of this are, that oil is easier to replenish and more cleanly than coal; it allows of a reduction being made in the stokehold staff; and a fresh supply of fuel is less frequently necessary.

(4) If oil fuel is carried, one point on which special stress has been laid will have to be sacrificed, namely, the carrying of water ballast. With two good condensers on board, this difficulty should easily be overcome. The storage capacity for fresh water should be 150 tons in tanks, with a distilling apparatus capable of producing 30 tons a day. A daily consumption of 20 tons would give 400 persons over 10 gallons a head, which sounds a liberal allowance aboard ship.

(5) The engines and boilers should be placed as far aft as is compatible with stability and safety. For this purpose I think it is worth while sacrificing speed. Then the forepart of the vessel can be devoted to the hospital, and the wards will be well away from the heat of the boilers and the noise and smell of the engine-room.

(6) Two decks, well above the water-line, should be given up to wards, operating rooms and dispensary. For officers there should be four cabins, each containing one cot, two small wards containing four cots, and one ward for eight cots. For men, there should be two main wards with six cabins for insane patients, while on the upper deck there should be a small infectious ward and a small ward for tubercle cases. Two operation and preparation rooms should be provided, placed in well-lighted positions and convenient to the main wards. Attached to one operation room should be an X-ray room. It is preferable to treat all cases in cots, and to provide small wards for officers rather than separate cabins and berths.

(7) The space between decks should be at least 8 feet clear, and all woodwork should be of the plainest description. The decks should be of plain unpolished wood and not covered with linoleum, except in the operating rooms and sanitary annexes, where mosaic or cement floors should be laid.

(8) The lower deck portion of the hospital should have a laundry, disinfector, refrigerating room, ice-making machine, and store-rooms. No unnecessary stores or bedding should be kept in the wards. A large drying room should be attached to the laundry.

(9) A cubic air space of 500 feet per bed should be provided. In the United States hospital ship "Relief," from only 238 to 312 cubic feet are provided; in the "Victor Emmanuel," 333 cubic feet were considered insufficient; while in the "Coromandel," fitted out in 1895 for the West Coast of Africa, from 630 to 770 cubic feet were allowed.

(9) The cots should not be superimposed, and there should be a clear space all round each to facilitate examination and washing of patients.

(10) The scuttles should be large, to allow of free ventilation, and there should be a plentiful supply of electric fans to each ward. In the provision of artificial ventilation, a system similar to that installed in H.M.S. "Dreadnought" would be suitable. This combines heating and ventilation. The air is driven by electric fans

over pipes containing steam, and then on through tubes to the various spaces requiring to be heated. The steam can be shut off and the apparatus used for ventilating only. With this the temperature can, I believe, easily be regulated and kept from 20° to 30° above the temperature of the outside air.

(11) The lighting should be entirely by electricity, with a light and switch over each bed in a ward. Dynamos should be capable of working the sterilisers, kettles, heaters, X-ray apparatus, ventilating fans and lifts, in addition to the lighting.

(12) In all adapted ships great inconvenience has been found as regards the positions of the closets and bathrooms with respect to the wards. They should be close to the main wards, cut off by an intervening passage, and washing places for the cleansing of ward utensils should be provided.

(13) The arrangements in case of fire should be as easy of manipulation as possible. Hoses and branch pipes should be kept ready rigged and pressure kept on day and night. This is essential, as in all probability a number of men will be helpless, and rapidity of action will be a matter of the utmost importance.

(14) There should be an ample provision of large lifeboats capable of taking the total complement without crowding, and two steam launches, each capable of towing all the other boats in the ship.

(15) There should be four large embarkation ports, two for each deck on which the main wards are situated, with four cot-lifts, worked by a motor, for hoisting men out of boats alongside. A special provision of cots and stretchers should be made so as to render dependence on the men-of-war unnecessary in this respect.

(16) All cooking should be done on the upper deck, small electrical heaters only to be provided in the wards for heating up beef-tea, &c.

(17) The laboratories, mortuary, photography rooms, &c., should be placed on the upper deck.

The cost of a specially constructed ship would be about £300,000, the cost of chartering a ship is about £400 a day, so that for permanent service, it would probably cost very little more to build a special ship than to purchase a ship suitable for conversion. The question to settle before undertaking special construction seems to be, could sufficient employment be found in peace time for a hospital ship to justify this outlay? It appears to me, that for combined naval and military work, such employment could be found. As a transport there is always work, I mean solely to

carry invalids, as I consider that a hospital ship should never be used for other duties than those connected with sick and wounded. Large fleets, cruising for even short periods, are in constant want of hospital accommodation. Changes of station take place, and until hospital accommodation is provided a hospital ship might prove invaluable; take, for example, such places as Crete or Cyprus, where a hospital ship would have been a great boon to the military; and as an instance in the Navy, Berehaven, where fleets sometimes make a long stay.

The matter of providing specially constructed hospital ships, and the question of their profitable employment in peace, are suggested as subjects suitable for discussion.

DISCUSSION.[1]

Fleet-Surgeon J. P. McNabb, R.N., congratulated Fleet-Surgeon Pickthorn on his masterly treatment of the subject of hospital ships. About the time that the hospital ship "Victor Emmanuel" was fitted out, another vessel, the "Simoon," was also equipped, but she rolled so heavily in a sea-way as to be useless. Fleet-Surgeon McNabb had had much to do with hospital ships during the last two years, and in his opinion the question under consideration should be looked at from three aspects: (1) The strategic aspect; (2) the structural aspect; and (3) the purely medical aspect.

As regards the strategic aspect of hospital ships, it was obviously impossible for them to come anywhere near men-of-war during an action. They would only be in the way of fighting ships, and have to be ordered off. In his opinion, a hospital ship ought to act as a base, to which men-of-war could proceed after an action, and transfer their wounded. It is conceivable that a hospital ship might follow in the wake of a fleet and pick up the wounded from any "lame duck." In the case of a naval war in the North Sea, hospital ships would hardly be required, as a fleet would never be very far from a naval base. Hospital ships would become much more necessary in the case of war at a long distance from a friendly port. In the United States navy it had been suggested that, when transferring wounded, the hospital ship should be brought close alongside the man-of-war, and the wounded transhipped by means of cradles running on wire hawsers. This could hardly be carried out in war time, as the man-of-war would almost certainly have all her masts, yards and top-hamper shot away, and there would be no means of rigging up the necessary apparatus.

With regard to the structural aspect of hospital ships, Fleet-Surgeon

[1] Reported by Lieutenant A. Irvine Fortescue, R.A.M.C.

McNabb believed that if they were fitted with wireless telegraphy apparatus, they would be liable to seizure by any roving destroyer, and either converted to the uses of the enemy or employed to send off false wireless messages. The actual details of construction would depend on whether the hospital ship was to act as an attendant on a fleet or as a semi-stationary base. In his opinion, a hospital ship need not be specially constructed *de novo*, but vessels destined for cargo-boats of the most modern type might be acquired on the stocks, and then converted. Emigrant ships were, he thought, most undesirable, as the ordinary European emigrant was hardly sanitary in his habits, and the ship would certainly require an enormous amount of disinfection. As regards dimensions, he quite agreed with Fleet-Surgeon Pickthorn that the best tonnage for a hospital ship was 5,000 to 6,000 tons, with a length of 450 feet; but he thought that a greater beam than had been mentioned was advisable. It was desirable that the principal medical officer aboard should have his office amidships, so as to be within easy reach of every part of the ship, and close by should be the ward-room and the quarters of the medical officers. He suggested that it would be best to have six cabins, with one large ward running athwart ship, as it would thus be more easily ventilated. The space between decks should be at least 8 feet, and the wards should be high above the water. A flush deck was preferable to a detached poop, bridge-deck and forecastle, and in a converted merchantman the wells between these ought to be filled in. The provision of a permanent awning was most important, as the spreading and furling of an awning would greatly disturb the patients. The decks, he considered, should not be of plain wood, but of iron covered by linoleum, as wood required too much labour to keep it properly clean.

As regards the medical aspect, there should be plenty of space between the latrines and the wards, such passages being utilised for baggage ports. Water ballast was not a desideratum. It should never be considered as part of the water supply of a hospital ship, and condensed water alone should be used for drinking purposes.

Fleet-Surgeon W. A. Whitelegge, R.N., regretted that he had not much to say from personal experience of hospital ships. He did not at all agree with Fleet-Surgeon McNabb that linoleum on iron made a good deck; an iron deck warped with changes of temperature, forming hollows beneath the linoleum, in which dirt accumulated and which required constant cleaning. The question of transhipping wounded from a man-of-war to a hospital ship after a battle, must always present great difficulties. It would often be impracticable to rig up apparatus by which the wounded could be transferred directly; and a hospital ship ought to carry a large number of boats, and a crew sufficiently numerous to man them. Such "hospital boats" should be as large as possible, with a broad beam and square stern. The hospital ship should be fitted with

large and powerful derricks to hoist the hospital boats outboard and inboard. In order to accomplish transhipment of wounded satisfactorily, much practice in peace time was required.

Fleet-Surgeon P. W. Bassett-Smith, R.N., said that, in his opinion, the most important matter in connection with hospital ships was the transhipment of wounded. A man-of-war after an action would have no boats available, as they would all have been discarded or shot to pieces by the enemy. Hence the provision of boats for a hospital ship should be very carefully studied. As regards the position of hospital ships in war, they might perhaps be kept near the fleet to pick up wounded or to take survivors off sinking ships; but more probably they would be retained at a base, to which the men-of-war would repair from time to time to hand over their wounded. A hospital ship might have an important use as a sick transport in time of peace. It would undoubtedly be more economical to have a special ship properly fitted out and used as a sick transport, than to pay the passages of invalids aboard ordinary transports or liners, where there is no regular nursing staff. Aboard a hospital ship there would be a good nursing staff, adequate medical and surgical equipment, and medical officers with special knowledge of tropical diseases.

Fleet-Surgeon R. Miller, R.N., considered that we were much handicapped in the discussion of the question of hospital ships by the fact that there had really never been a prolonged modern naval war. With the possible exception of one battle outside Port Arthur, where the losses seem to have been fairly evenly distributed, modern naval engagements have been mere butcheries, in which the vanquished, who have been practically wiped out, have either had no special medical arrangements, or if they have, have been totally unable to carry them out. He believed that the most important point in the equipment of a hospital ship was the provision of a large number of special hospital boats, with extra powerful derricks to hoist these boats in- and out-board. A modern, moderate-sized liner carries ten or twelve large lifeboats, and a hospital ship should have at least as many. In construction, hospital boats should be beamy, flat-bottomed, made, if possible, to fit one inside the other, and provided with a permanent canvas awning. This awning should have an opening aft to allow the passage of cots. Such boats should be built to accommodate eight to ten persons.

With regard to Fleet-Surgeon Pickthorn's idea that the engines in a hospital ship should be placed right away aft, Fleet-Surgeon Miller could not agree, but considered that the engines should be amidships, allowing hospital accommodation both forward of and abaft the engine-room. As regards the speed of hospital ships, it should be at least a possible 20 knots. A 20-knot boat driven at 16 was far steadier than a 16-knot boat driven at top speed. He thought a refrigerator ought always to be of large size; on liners it was used to accommodate the

coffins of deceased passengers, whose relatives could thus easily take the bodies home. He believed that large wards subdivided by wooden or canvas screens were very much better than a number of small cabins. Large flush-decked steamers were seldom built nowadays. In his opinion linoleum on iron was a very bad form of flooring, being impossible to keep thoroughly clean. In the United States Navy some of the decks are coated with shellac, others with rubber, either in mosaic or in sheets. The latter seemed very satisfactory.

Hospital ships would be largely required as carriers in war time, but it would, he thought, be very expensive and hardly practicable to keep such vessels equipped in time of peace. In his opinion converted merchantmen would be perfectly satisfactory. We must recollect that naval warfare was very unlike a campaign on land; a naval battle lasted for minutes, not months: If the fight was decisive the disabled ships would soon be towed into port, where their wounded would be attended to. After an indecisive action both fleets would have to continue to cruise, and carrier hospital ships would be urgently required to take off the wounded from the men-of-war. He considered that ordinary high-speed, shallow-draught passenger-boats of handy size, such as the cross-channel packets, were admirably suited to conversion into such hospital carrier ships. The captains of such steamers were well accustomed to coming alongside quays and jetties in all weathers, and to rapidly getting up steam.

Deputy Inspector-General A. W. May, R.N., said that the great difficulty with regard to hospital ships was to get Government to vote the necessary sums; £300,000 would be required to construct such a ship *de novo*, and such a large amount would be conceded only as the result of strongly expressed public opinion. It was the bounden duty of the great medical profession, as well as of the medical officers of the Navy and Army, to leave no stone unturned to awaken public opinion to the grave importance of this question.

Mr. G. H. Makins, C.B., F.R.C.S., said that as an amateur he felt considerable diffidence in offering his opinions. He thought that it was only by having special hospital ships constantly at work that a knowledge of how they can best be utilised was to be obtained. The choice of merchantmen for conversion into hospital ships must be made most carefully. The experience of the Russian fleet was that hospital ships were exceedingly useful to carry the sick and wounded which accumulated in a fleet in the course of a long voyage. After an action the work of a hospital ship must be chiefly that of a sick transport. Such a vessel, Mr. Makins considered, was hardly likely ever to be called upon to act as a hospital for any length of time in mid-ocean. Every hospital ship ought to carry a portable hospital, which could be pitched on shore when the distance to an accessible seaport with good hospitals was very great. Mr. Makins suggested the employment of lighters in the tran-

shipment of wounded, and thought that a certain number of these might be carried by hospital ships. He was strongly opposed to the covering of decks with linoleum, which was impossible to keep clean and bound to get untidy at the joins. Linoleum might be cheap, but it was also untidy and nasty.

Surgeon G. Ross, R.N., referring to the construction of hospital ships, said that he considered 4,000 or 5,000 tons far too small; 8,000 or 12,000 tons would be much better. He pointed out that it was absolutely necessary to have a large space between decks to allow of proper ventilation, and that it would be impossible to fit two decks with 8-feet between-deck spaces, into any but very large ships. It was important, too, that the decks should be high above the water. In their late war the Japanese found that 2,000 ton hospital sick transports were far too small. The operating room should always be on the same deck as the principal surgical wards. As regards the speed of hospital ships, he thought 16 knots was quite insufficient. A battle fleet often steamed at a speed of 17½ knots for days on end, while a cruiser squadron would steam at 23 to 24 knots. A hospital ship must be swift enough to be able to keep up with the fleet. He suggested 20 knots as a minimum. Oil fuel would be a great advantage, allowing much more room for wards, the quarters of the medical staff, &c. Hospital boats for the transhipment of wounded from men-of-war to hospital ships should be large, and provided with oil engines. He did not think that patients ought to be transhipped in their cots; they should be placed aboard the hospital boat while the latter is still inboard, then boat, patients and all, should be hoisted out by means of a powerful derrick.

Fleet-Surgeon A. G. Andrews, R.N., considered that large modern emigrant steamers were eminently suitable for conversion into hospital ships. The "President Grant" and "President Lincoln" of the Hamburg Amerika Linie, were good examples of such vessels. The Hamburg Amerika Linie had built a hospital carrier, provided with a large well amidships, so that loaded hospital boats could be hoisted aboard and lowered into this well straight away. He thought this type of carrier might be copied with advantage.

Sir Herbert Ellis said that the question of expense was the great difficulty. It would take a very great deal of pressure to make Parliament vote £300,000 for a hospital ship. He agreed that hospital boats used in transhipment should be large and have plenty of beam. He thought that they might often be towed by steamers. He was very much afraid that the most awful chaos would result the first time a hastily converted hospital ship was manned. The medical officers, nurses, orderlies, and crew would all be strangers to each other, to their boat, and to many special features of their work. Many of the medical staff would probably be incapacitated by sea-sickness as soon as they got out of port. He should be very sorry to have to go down and see the first batch of

wounded disembarked from such a vessel. He considered that a hospital ship would prove of the very greatest benefit in bringing home invalids from the East. At present the lot of sick men coming home aboard the ordinary passenger liners was not a happy one.

Fleet-Surgeon E. B. PICKTHORN, R.N., in summing up, said he could not agree with Fleet-Surgeon McNabb that hospital ships would not be required in the case of a naval engagement in the North Sea. An ordinary cargo boat would take a long time to convert into a hospital ship, and would require a great deal of disinfection. Iron decks got very hot in the Tropics, and linoleum laid over them soon began to warp and get smelly. In the case of the "Malacca," used in the Benin Expedition, varnished decks were reported on as unsuitable, because they got quite sticky in the Tropics. He agreed with Fleet-Surgeon MacNabb that water ballast should never be used for drinking purposes; he thought that modern condensers would provide sufficient water. He feared Fleet-Surgeon Whitelegge had misunderstood his reference to transhipment of wounded by means of wire hawsers and cradles. Hospital boats must, he thought, always be the most reliable method. It was true that Fleet-Surgeon Stokes, of the United States Navy, had devised a method of transhipment by hawsers; but for his part he did not think that it could be carried out successfully under the conditions of modern naval warfare. As regards the finding of the £300,000 required to build and equip a hospital ship, he thought that an appeal might be made to the British Red Cross Society to start an agitation in favour of providing the Navy with so important an addition. In conclusion, he considered that turbines were far better than screws for a hospital ship, as they kept the ship much steadier in a sea-way; also with them it was easy to attain the chief desideratum of all, namely, speed.

Sir HERBERT M. ELLIS, K.C.B., K.H.P., F.R.C.S., Director-General of the Medical Department of the Royal Navy, proposed a vote of thanks to Fleet-Surgeon E. B. Pickthorn for his most interesting paper, which was carried with acclamation.

THE MEDICAL OFFICER, THE RECRUIT, AND THE GYMNASIUM.[1]

By Lieutenant A. C. AMY.
Royal Army Medical Corps.

Contents.

(I.) Introduction.

"He will frequently visit all places set apart for the physical training of the troops, and will give his advice on such subjects, especially with reference to recruits, noting in his diary the names of men whose training is modified, as well as their subsequent progress,"—*paragraph* 61, "*Regulations for the Army Medical Service.*"

The above regulation has a deeper meaning for us now than is generally realised, inasmuch as the difficulties of carrying out its provisions in the spirit as well as in the letter are real though not at all obvious. It is therefore probable that the matter cannot be mentioned too frequently in our Journal, particularly at the present time. During the past twelve months I have been on duty at the Headquarter Gymnasium at Aldershot, and in that time it has become more and more evident that the medical officer, through no fault of his own, is not in a good position for giving "his advice on such subjects," or for modifying the training properly. He may visit the gymnasium conscientiously, but his special advice is only occasionally required, and he need never interfere except in evident pathological conditions, for which no special regulation is necessary. But among recruits there are many border-line cases which, on common-sense grounds, may be recognised as abnormal in some way. In order to handle such individuals, assistance is required

[1] This paper was received on March 16th, 1907, *i.e.*, before the publication of Dr. Pembrey's address.—Ed. Royal Army Medical Corps Journal.

by the gymnastic instructor, for he is not a doctor; similarly, the medical officer alone cannot deal with them, as he is not a physical training expert. It is true that some medical officers believe themselves to be physical training experts simply because they *are* medical officers, but to my mind, and in view of my recent experience, such reasoning is quite unsound. The theory and practice of physical training require a considerable amount of study of a kind not included in the ordinary medical curriculum, and until this is realised we shall fail to take full advantage of the many opportunities afforded us of doing good work in the gymnasium. In proof of this one need only note the wide divergence of views, and listen to the absurdly antagonistic suggestions expressed by medical men both in and out of the Services. For instance, some advocate nothing but football and cricket; others cross-country running, route-marching, and so forth. However estimable such ideas may be in themselves they are neither sufficiently broad nor do they go nearly far enough. On the other hand, if we made physical training a subject of serious study, the relative value of the above excellent exercises would be understood, our position as regards physical training would be immensely improved, and the recruit would benefit accordingly.

This paper, therefore, is written as a humble attempt to put before the officers of the Corps various points worth consideration, with a view to the solution of our difficulties.

II.—Physical Training.[1]

The complete training of the soldier from a physical standpoint includes any and every means used for benefiting his physique. Hence it embraces "physical training" under expert gymnastic instructors, barrack-square drill, route-marching, running training, &c., and all kinds of active indoor and outdoor games and sports. Unfortunately, however, there is a distinct lack of organisation and interdependence in much that goes to make up the recruit's physical life; the different parts are generally isolated and have little to do with each other, so that uniform progression is impossible. The gymnastic instructor is satisfied with *his* part of the business, and the drill-serjeant with *his*, but the student

[1] On the Continent the word "gymnastics" is synonymous with "physical training," and is used in this sense throughout this paper. In this connection it should be noted that there is no such thing as "Swedish drill"; "The Swedish System of Gymnastics" (*i.e.*, physical training) is the correct term.

of physical training must regret that this failure of co-ordination should result in work being done in certain branches, without due consideration for, and reference to, the work done in others. With regard to the gymnasium in particular, the recent introduction of a systematised form of training has been looked on with suspicion as another undesirable alien! Tradition and conservatism lead us to believe that games and sports are all-sufficient, but those who have studied the subject realise the weak points in such a belief, and recognise that something more systematic is wanted for training the recruit type. All kinds of games and sports are important adjuncts to, but not substitutes for, a properly devised system of physical training. Unfortunately, lack of space and money render them impracticable when large numbers of men have to be dealt with. Besides, the physically strong derive benefit from them at the expense of the weakly who, by reason of their defects, are discouraged from participating—except as spectators. Again, games and sports are not graded in any way; many of them are one-sided, and they are not devised to secure harmonious development of the physique.

III.—Position of "Attention."

This is a "strictly military attitude"[1] according to gymnastic precepts, but it is more; it is a natural, erect position of readiness,[2] and is THE foundation of all work performed in Army gymnasia. The gradual efforts which are made to approximate to this fundamental carriage of the spine in the various positions, go a very long way towards obtaining the required results.

(*A*) Several new and important features will be noticed in the definition of the position given in the Manual. For example, the foot-angle should be about 60 degrees, and the weight of the body should fall midway between the forepart of the feet and the heels (*i.e.*, a little in front of the ankle joints), so that balance may be natural. Instructions are given which well describe the correct position of the head and shoulders, chest, abdomen and hips. "The breathing must not be restricted in any way," and "there should be no stiffness or forced unnatural straining" while maintaining the position.

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[1] *Cf.* Dr. Pembrey on "The Physiological Principles of Physical Training" at the United Services Medical Society's Meeting, February, 1908, and this Journal, March, 1908.

[2] *Vide* "Manual of Physical Training," 1908, paragraphs 91 and 398.

No mention is made of "hips drawn back," "chest advanced," or "weight of the body on the forepart of the feet." Indeed, some of these points are black-listed in a useful paragraph headed "Common Faults."

(*B*) "It should be noted that a correction of the carriage of

Fig. 1.
Naturally erect.

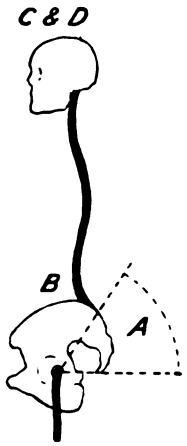


Fig. 2.
"Round back."

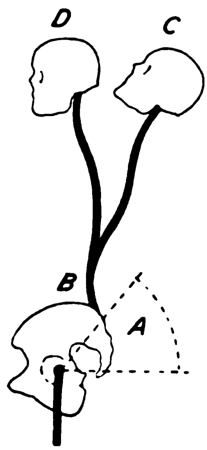


Fig. 3.
"Hollow back."

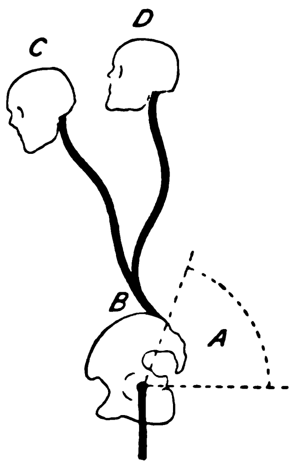


	Fig. 1.	Fig. 2.	Fig. 3.
Pelvis	Normal ..	Tilted back	Tilted forward.
Angle A	,, ..	Decreased	Enlarged.
Angle B	Constant ..	Constant	Constant.
C = Position of head and spine, depending on "A"	Normal ..	Leaning back	Leaning forward.
D = Correction for "C"	—	Straight lumbar curve; flat, depressed chest; forward, drooping shoulders; poking chin	Hollow lumbar curve; rigid, distended chest; shoulders thrown back.
Result of "D" on average muscular lengths	Erector, spinæ, &c.	Lengthened	Shortened.
	Rectus abdominis	Shortened	Lengthened.
	Hamstrings	,, ...	,,

the neck will usually have the effect of correcting the carriage of the whole body." The simple movements of drawing the neck back while keeping the chin in, and trying at the same time to "grow tall," have a remarkably good corrective effect when deportment is unsatisfactory (*vide* fig. 15.)

(*C*) "It must be noted that a recruit who has had no previous training cannot be expected to attain this, or any other, position correctly at once, and that attempts to correct his positions too suddenly, are certain to have injurious rather than beneficial effects. The principle of gradual, not forced or hurried, progression, should therefore be most carefully kept in view, and the instructor must be satisfied with any improvement, however slight, providing it is steadily and gradually maintained."

(*D*) The attainment of a correct position is most frequently interfered with by a stooping posture—rounded back, forward-drooping shoulders, flat chest and poking chin. The next most common type is the reverse, viz., "hollow-back." It has been found that in these cases abnormal tilting of the pelvis is the primary cause; this is generally acquired as a result of faulty positions assumed in civil life and work, and in accordance with this the average lengths of the muscles are altered.

The rough diagrams on preceding page (exaggerated for purposes of illustration), show these conditions.

IV.—The Swedish System.

History.—The Swedish System represents the life work of Pehr Henrik Ling, and has been the national—one might almost say universal—system of physical training in the Scandinavian countries for nearly a century. Ling was a highly educated man, *littérateur*, classical scholar and soldier. Before completing his work, and solely for his work's sake, he spent nearly thirty years in the study of anatomy, physiology, pathology, hygiene, and similar allied sciences. He had, therefore, a masterly knowledge of the human body, its possibilities and limitations, so that he was well equipped for his labour. Ling died in 1839, and since then the system has been carried on and perfected.

The influence of Swedish gymnastics has been gradually making itself felt in England for the last twenty years, but with the exception of the work done by Madame Osterberg, at Dartford, no real advance was made until 1902, when the system was introduced into the Navy on the recommendation of Colonel Fox, late Inspector of Army Gymnasia. In 1904 the Board of Education sanctioned a syllabus of training based on this system, for use in elementary schools throughout the country. In 1906, the system was adopted by the Army, when, by permission of the Danish Government, Lieutenant Langkilde, M.V.O., 5th Danish Infantry, came to

Aldershot for a year in the capacity of instructor. A new Manual of Physical Training has been written, and is only awaiting official sanction before issue. This book will be found to be a complete and reliable guide to the work now being carried on in the Army gymnasia.

General Principles.—The key-note of the whole system may be embodied in the words *progression and adaptability*. The Swedes recognise three primary divisions, viz.: (*a*) *Educational*, directed towards securing a gradual, progressive and harmonious development of the entire physique, with quickening of the mental faculties. (*b*) *Medical.* (*c*) *Æsthetic.*

As medical and æsthetic movements are outside the province of the Army gymnasium, this paper deals only with the educational aspect, at the same time keeping in view the fact that the soldier is trained in order to prepare him for the strain and stress of active service. In other words, the same system is equally applicable to civilians of both sexes and all ages, but in this case certain exercises, not of practical value for the soldier, are omitted, others being substituted. It is merely a question of drawing up tables of exercises suitable for the pupils under training. Each part of the system forms an essential portion of the whole; without some of its parts the training becomes inadequate, but with all of them, it is scientifically sound and complete. It is important to remember that the value of Swedish gymnastics cannot be estimated by observing a few isolated exercises. In order to make a fair criticism, it is necessary to consider the system as a whole, so greatly do the benefits of performing one portion of it depend on the performance of all the others. For example, it has been averred that the system is too "mild," but it cannot be judged by watching a few easy exercises, unless one considers how they are embodied in the general scheme; as a matter of fact, the system can be applied so as to test the capabilities of the strongest if necessary. There are many simple and easy exercises which are used beneficially, not only by the beginner, but also as a change from the more strenuous work of the advanced pupil. Indeed, this is one of the features of the system, whereby progression is obtained from simple to more difficult work in the case of the weakling, and a judicious mixture of easy and hard work in the case of the strong. Thus the required result is attained without letting the pupil feel any undue strain.

Again, an objection has been raised that there are too many "set" exercises and not enough freedom, but this is really a question of application. "Set" movements have their proper

place in the daily lesson and in the scheme of training, but with them are included a number of exercises of an essentially free, practical and even recreational nature, so that interest, individuality and emulation are thoroughly aroused. Each exercise has some specific object in view, which, if not at first apparent, gradually evolves as the training progresses. Every part of the body receives its due share of attention, not only the muscles and joints, &c., but the internal organs as well. Of course the latter are trained by means of muscular action, but muscle-building in itself is considered as of no importance. If the recruit is turned out with a sound "wind" when taxed, it is certain that his (voluntary) muscular strength will suffice for his requirements and for his good. For instance, certain exercises are used for the express purpose of strengthening circulation and respiration, and it is in these that the principle of gradual progression is especially noticeable, so that the risks of sudden and undue strain are reduced to a minimum. Acrobatic "show tricks" are rigidly excluded, and the element of danger is avoided as far as possible. Unnecessary drill movements are also prohibited, "moving free" having replaced them.

The system aims at turning out a soldier with a good all-round development; that is to say, a man with a reasonable amount of physical strength, able to march and run well, sound in "wind," with a good natural upright carriage, smart, agile and alert, and capable of using his wits. Although these are high ideals, yet—bearing in mind the physical limitations of the raw material dealt with—the gymnastic staff is satisfied that they are being realised to a far greater extent than was possible under the old system.

Classification of Exercises.—All the available exercises are collected into a general list, under the following group headings: (*a*) Leg; (*b*) neck; (*c*) arm; (*d*) span-bending; (*e*) heaving; (*f*) balancing; (*g*) lateral; (*h*) abdominal; (*i*) dorsal; (*j*) marching and running; (*k*) jumping and vaulting.

The different exercises under these headings are arranged in progressive order, and in the composition of tables, they are selected in such a way that each table contains one or more representatives from each group, while a series of tables progresses in difficulty from first to last during a given period of training.

Formation of Tables.—In each table the different parts of the body are exercised in a consecutive and rational manner, while a particular table prepares for the one which is to succeed it. A table is subdivided into Introductory, General, and Final exercises.

The Introductory exercises consist of easy leg, neck, arm, and

trunk exercises, for the purpose of ensuring a good carriage and true balance, improving muscular control, and arousing the attention of the class. In addition, they are devised so that the work is easy to begin with but, becoming harder, the circulatory, respiratory and nervous systems are gradually tuned up to meet the more strenuous efforts required for the general exercises; popularly speaking, a "warming up" process takes place.

The general exercises form the real working part of the table, and are followed by the final exercises. The latter consist of easy, simple movements, during which the circulation and respiration calm down, and a good carriage is maintained. In short, they are intended to bring the body fairly near the normal resting condition before the class is dismissed.

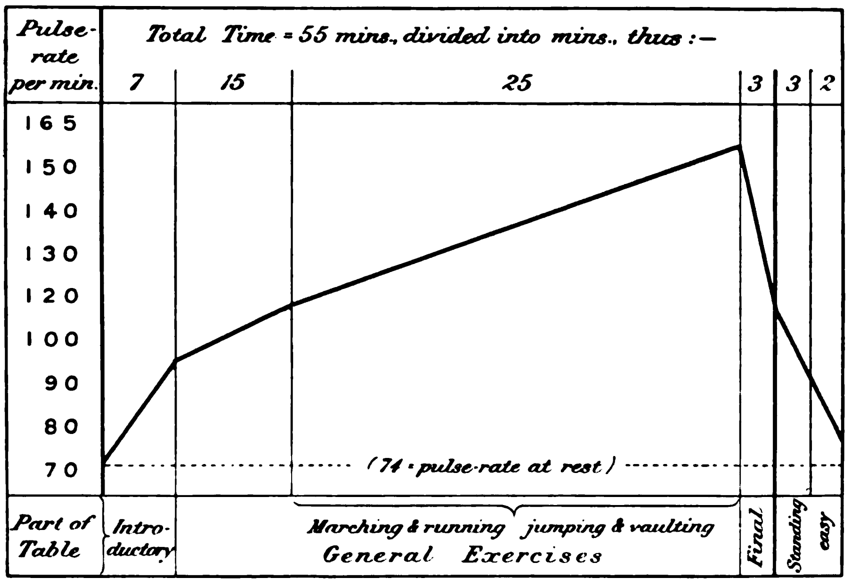


Diagram comparing pulse-rates during performance of a table (averages from eighty-seven men).

Arrangement of Exercises.—In the "General" part of a table the exercises, conforming to the dominant idea, are performed in a definite progressive order, thus:—(*a*) Span-bending, (*b*) Heaving, (*c*) Balancing, (*d*) Lateral, (*e*) Abdominal, (*f*) Dorsal, (*g*) Marching and running, (*h*) Jumping and vaulting.

Span-bending is taken first, as it requires concentration of mind and energy, rather than hard muscular work. Also, the class must

be fresh and unflurried when carrying it out, as it is so important to obtain a correct position. To the uninitiated the exercise may appear useless, perhaps ridiculous, or even dangerous, but this is not the case. Span-bending affects the dorsal part of the spine in a manner of which no other exercise is capable. In a mechanical fashion, it produces what little straightening is possible in this part of the column; at the same time, the dorsal muscles are actively shortened, while the abdominal muscles are passively stretched.

FIG. 4.—Preparation for span-bending. This is a good position.

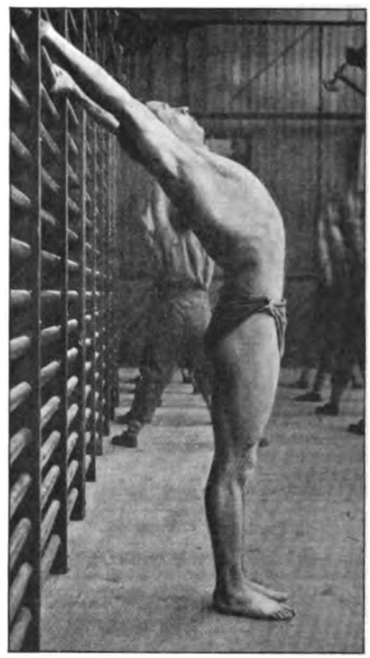


FIG. 5.—Position for span-bending. In this case the feet should be about three or four inches further from the wall-bars.

The ribs are more or less raised and separated, resulting in an improvement of the mobility of the chest walls. Consideration will therefore show that it is especially beneficial in the case of the individual with round, drooping shoulders and flat chest. During the maintenance of the position breathing may be slightly impeded, but in this case—as in a few other exercises where there may be a tendency to "hold the breath"—the instructors should be very careful that no undue restriction of respiration occurs; besides,

any harm which might arise in this way is negatived by the fact that such positions are never held for any length of time (*vide* figs. 4, 5 and 6).

Heaving exercises, as compared with span-bending, require physical strength rather than mental concentration. The correct position is first taught by such easy exercises as "arch-hanging" (*vide* fig. 7) and "fall-hanging." During "heaving" the elbows

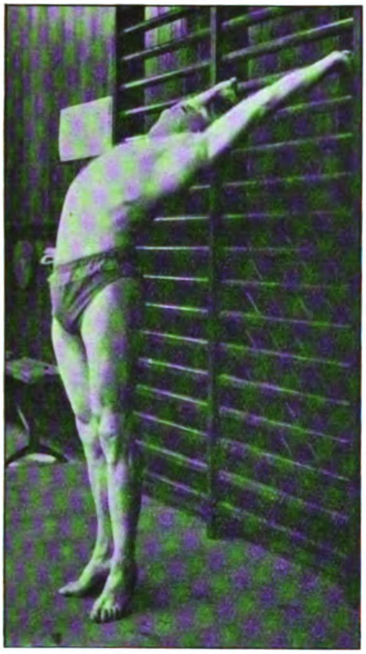


FIG. 6.—Span-bending. The "grasp" should have been taken one bar higher. As the man had to pose for a "time exposure" photograph, there is more strain in the position than there would be during an actual performance (this remark also applies to fig. 15).

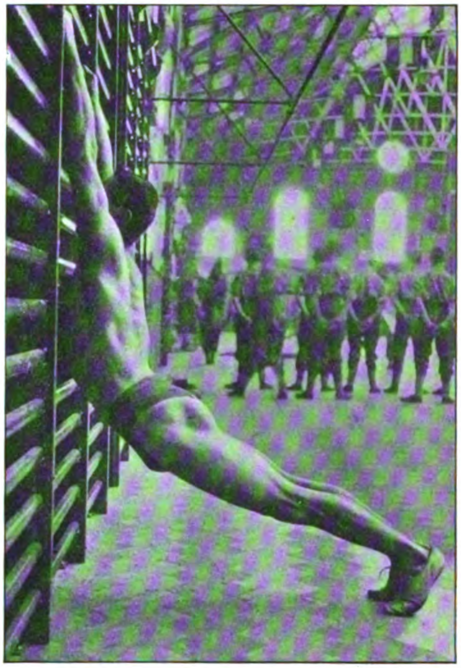


FIG. 7.—Arch-hanging, preparation for heaving. The relative position of the body and arms to the wall-bars makes it practically impossible to assume a bad attitude, so long as the "grasp" is taken at the proper height.

are kept wide apart, so that the chest advances free from compression: in fact, the latissimus dorsi does the work, not the pectoralis major. Correct *style* is the object aimed at; pulling to the chest so many times merely for the sake of pulling, is absolutely forbidden. A man who is fatigued loses the correct position, the head and shoulders come forward, the elbows press on the chest,

and breathing is restricted. Supervention of any of these factors is a warning that the exercise should be modified or discontinued (*vide* figs. 8, 9 and 10).

Balancing exercises are taken next, in order to rest the muscles after the work of "heaving," to counteract any stiffening consequent on the latter, to develop nerve control and muscular co-ordination, and to act as a "supplementary" exercise (*vide* below). Later,

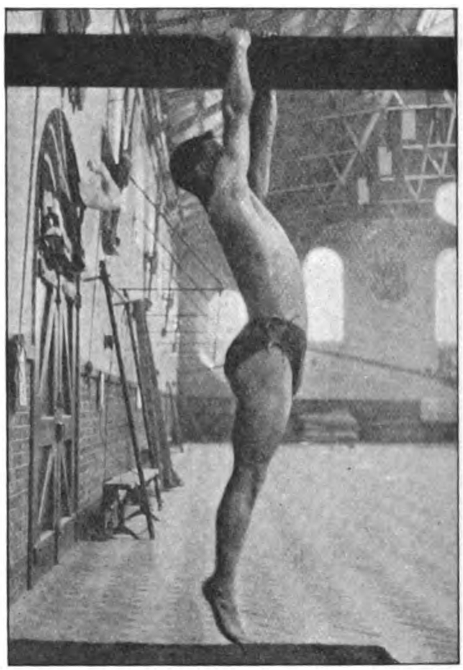


Fig. 8.—Heaving, cross-grip starting position. The body is hanging too loosely between the arms; the points of the elbows should be farther apart, so as to prevent pressure on the chest.

these exercises are put to practical use during obstacle-training in the field.

Trunk exercises have marked educational qualities, inasmuch as they are particularly beneficial to those whose deportment and physique are not what they should be. The lateral exercises train the muscles on both sides of the body equally, in contradistinction to most forms of manual labour and games. They also assist in increasing the mobility of the chest walls, and in straightening the

spine. In common with the abdominal group they have, to some extent, a massage action on the abdominal viscera. Dorsal exercises complete the trio. They are "complementary" to the abdominal exercises, and ensure a good carriage for the marching and running which follow. A type of this group is "trunk bending forward," which should not be confused with "trunk bending downward" or "full downward," as their effects on the dorsal muscles, and position of head, neck, chest, &c., are very different. As a matter of fact, the last-named is practically only used as the

Fig. 9.—Heaving. This is the correct position, upper arms and elbows clear of the chest.

Fig. 10.—Heaving, over-grip. This is a bad style, and shows several common faults.

"complementary" exercise to span-bending (*vide* below). Dorsal exercises are frequently performed on benches, from the starting position of "forward lying." This seemingly difficult position is, in reality, quite an easy one to assume. Allowing for the horizontal lie, the attitude of the body is precisely the same as in "Attention"; only the dorsal muscles are working, those of the abdomen and chest remaining relaxed. I have made a considerable number of observations during the performance of this exercise, but I have never seen undue congestion of the face and neck, respiratory obstruction, or cardiac disturbance produced (*vide* figs. 11, 12, 13, 14).

So far as they go, the following pulse-rates are typical:—

POSITION OF "FORWARD LYING."

Sex	Age	Remarks	Normal pulse	In the position (pulse-rate per minute)	
				During first 10 seconds	During second 10 seconds
M. ..	7	Healthy	99	105	108
M. ..	23	Phthisical	84	87	88
F. ..	12	Healthy	78	80	80
M. ..	32	Obese (weighs 17 st.) ..	72	73	75

In the next two groups the heart and lungs are gradually strengthened, and, with the training of his "wind," the recruit is

FIG. 11.—Forward bending, with arms stretching. The abdomen is in such deep shadow that a somewhat erroneous impression is conveyed; the head should be farther back, but otherwise the position is excellent.

taught to move about in a natural, quick, easy and quiet manner. These parts of the table are taken last, because they are the climax of the day's work, and bring the class to its highest pitch of activity and vigour. Marching, running, jumping and vaulting are progressive and practical, and much time and attention are devoted to them. Running is done on the ball of the foot, the stride is long and natural, the arms swing freely from the shoulders, and the elbows are but slightly flexed. Jumping and vaulting are devised to make the men active and handy in the field. When a vaulting-horse is used, the exercises are performed without a spring-board or mattress, so as to develop the natural power of spring and aptitude for "landing" easily.

The Swedes bring the final exercises to a close by performing formal and definite breathing exercises, and round these a vast amount of discussion has taken place.[1] For instance, at the Congress of School Hygiene held in London last August, many speakers, principally English medical men, referred to this subject. Everyone favoured the performance of breathing exercises, or tended to, while none spoke of them with dubiety, much less condemnation. The opponents of these exercises were either absent, or silent during the debate—a remarkable fact, considering how strongly they urge their views as a rule. However, there is no doubt that the Swedes advance certain reasons for their breathing

A. B.

FIG. 12.—A, downward, and B, full downward bending, with arms stretching. In "A" there should be no lumbar curve. "B" is generally performed as a complementary exercise to span-bending.

exercises which are either scientifically unsound, incorrect, or at the best unproved. Bearing this in mind, we have adopted a number of movements that have recently been somewhat aptly termed "Corrective." They are performed *not* because it is believed that the oxygen-containing power of the blood can be unnaturally increased, and *not* because it is thought desirable to "expand the men's chests"; such criticisms are quite superfluous and inapplicable so far as the Army system of physical training is concerned. But it is claimed that these movements help to straighten the spine, and increase the mobility of the chest walls.

[1] *Vide* Review of Professor Guermonprez's "Gymnastique respiratoire pendant les ouvements," *Brit. Med. Journ.*, April 11th, 1908.

In addition, they *may* teach the pupil how to make the best use of his respiratory apparatus, and it is possible that they may assist in calming the circulation and respiration,[1] but at present these points are problematical, and cannot be put forward as beneficial results of the exercises.

With regard to the abstract question of respiration, slow neck, arm and trunk movements are usually performed in the time of a natural, easy respiratory cycle; thus, "head bending backwards" should correspond with inspiration, and "head stretching upwards" with expiration. But in connection with this it is well to point

FIG. 13.—Position of forward lying. This is the correct attitude.

out that, at the Headquarter Gymnasium, instructors are warned against drawing the recruits' attention to the respiratory act, and are impressed with the importance of encouraging nasal breathing as much as possible, and of discouraging any tendency towards forced, jerky or constrained breathing.

Application of the System.—Regimental N.C.O.'s receive from four to five months' tuition, and must pass an examination before they are allowed to train recruits in the gymnasium. They are taught to perform the different exercises correctly, how to handle a class well, and to impart instruction clearly, the principles of the system, and the application of elementary anatomy, physio-

[1] A large number of experiments and observations were made in the hope of determining this point, but the results were too inconclusive to warrant any definite deductions.—*Vide* also Lieutenant-Colonel H. E. Deane, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, May and June, 1907.

logy and hygiene to physical training. The certificate examination is searching and thorough, and it may safely be said that the successful candidate generally reaches a high standard, both in theory and practice. However, as the system in the Army is only emerging from its infancy, it is not to be expected that everyone is perfect yet; the work of training a sufficient number of competent instructors is being hurried on, and it is hoped that a uniform standard will be reached in another year or so.

Recruits attend at the gymnasium as follows:—

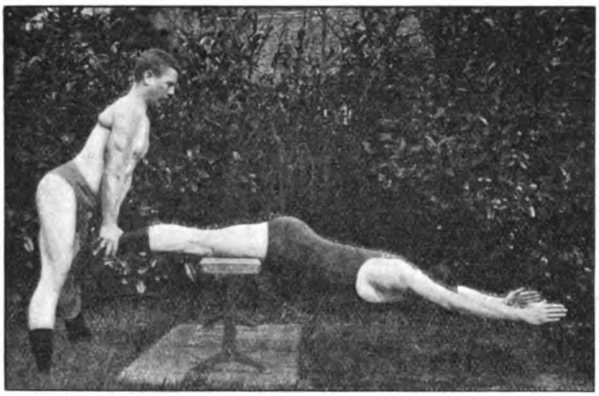


FIG. 14.—Forward lying, trunk bending downward, with arms stretching. A progression on fig. 13.

NUMBER OF ATTENDANCES.

	At Depôt	On joining Regiment	Total	For each table
Infantry	60 (Tables I. to VIII.)	50 (Tables IX. to XIII.)	110	7 to 10.
Cavalry Artillery..	60 (Tables I. to IX.)	..	60	6 to 9.

It has been suggested that the total number of attendances for infantry should be reduced to ninety, and this ought to give perfectly good results, if the spirit of the training is strictly adhered to. But at present it is an unfortunate fact that courses of physical training are too frequently interrupted by other work besides musketry. Not only is this against the regulations on the subject, but contrary to the demands of Nature, for it is impossible to benefit the ordinary recruit by condensing his physical

training. In addition, the outcome of a break in the continuity of the present progressive scheme can only be waste of time and material, followed by indifferent results. It will therefore be plain that, if anything is allowed to interfere with the continuity of the proposed reduced number of attendances, much harm may be done, especially if the above total is not regarded as an absolute minimum.

On joining the gymnasium the recruits are not graded in any way (except for medical reasons), but are placed haphazard in classes, which should never contain more than twenty men each.

FIG. 15.—Head bending backward. This is a typical "corrective" exercise; in this case the elbows are pushed a little too far back (*vide* also remarks on fig. 6).

Recruits of marked intelligence, strength and activity should not be "pushed" at the expense of their more backward fellows, but ought to act as examples to the latter. In this way the less efficient men are not discouraged, while the classes are imbued with a spirit of emulation and comradeship. Instructors are impressed with the advisability of revising old tables, but premature advancement to new ones is forbidden. With few exceptions, the exercises in the tables are performed in the order laid down and in the times specified. However, certain exercises may be interchanged, so that a class may not be kept idly waiting when

apparatus is occupied, *e.g.*, the lateral, abdominal, and dorsal; heaving with span-bending, &c. On the other hand, it would be quite inadmissable to perform span-bending after jumping and vaulting. A table, occupying fifty minutes, should thus be divided: Introductory exercises, five to seven minutes; General exercises, about forty minutes (marching, running, jumping and vaulting, twenty to twenty-five minutes); Final exercises, three to five minutes. A table, properly applied, leaves very little time for "Standing Easy."

Exercise must always be carried on out-of-doors in clement weather and where the ground is suitable.

[*Definition of Certain Terms.*—A "Corrective" exercise is one used to correct a fault, generally of deportment. Corrective exercises, as a whole, form the "Educational" part of the system (*vide* fig. 15). A "Complementary" exercise[1] has an opposite effect to one preceding it, *e.g.*, "Trunk bending downwards" after "Span-bending." A "Supplementary" exercise generally follows any exercise which tends to cause congestion of the vessels of the head, neck, or thorax, *e.g.*, "Knee-bending" after a strong "Heaving" exercise. The idea is that the muscles in action receive, comparatively speaking, a greater amount of blood than resting muscles, and that this result will be all the more evident in the case of the large and powerful leg muscles, which can perform a great deal of work without producing much general disturbance. The theory of relieving congestion in a potential danger zone by "deflecting" the blood-flow to a safety area, and thus speedily inducing circulatory equilibrium, may seem to be taking too much for granted. In point of fact it is no doubt questionable, and at present can only be regarded as a deduction. Still, the grounds for deducing what is claimed for the so-called Supplementary exercises are sound enough to form a working basis, and it may be confidently said that, in practice, at any rate, they seem to be distinctly beneficial].

V.—Medical Supervision of Gymnasia.

The suggestions contained below may appear somewhat novel, but I think it will be granted that they are based on common-sense grounds.

Firstly, the medical officer, before entering the gymnasium, should leave his stethoscope outside; surely the use of medical

[1] *Vide* "Depleting Movements," Dr. Arthur G. Bennett in *The Practitioner*, December, 1906.

impedimenta can be confined to inspection and sick rooms. The habitual production of a stethoscope in a gymnasium pre-supposes suspicion—at least in the minds of the gymnastic instructors—and the usual result is irritation, or even alarm, so that flurry and faulty work follow. The proper equipment for a medical officer in the gymnasium is a sound knowledge of physical training, and then his eyes will suffice to show him if the system is being correctly applied. If the instructor knows his business, most of the recruits may well be left to his care, the medical officer devoting his special attention to the backward men. In conjunction with the instructor he may, if necessary, modify the training of such as are mentally very slow, physically very weak, and so forth. However, on the whole, it will be found that interference is seldom called for, because the present course of training is so gradual and progressive (that is, if correctly applied) that, if a man is in any way fitted to be a soldier he is very unlikely to be injured in the gymnasium. In dealing with very backward recruits it is well to remember that it is usually inadvisable to recommend the discontinuance of any particular class of exercise, unless one's knowledge of the system and of the exercises employed is full and complete. For example, when a medical officer prohibits a man from performing a certain exercise he frequently overlooks the fact that there may be similar and stronger movements in the same table. Therefore, in special cases it is usual to advise that the man be transferred to a class which is working at an earlier and easier table, and that he should continue in that class until dismissal. When possible, the medical officer should not take the initiative in seeking out those cases which require his special attention; it is probably better to encourage the gymnastic instructor to bring to his notice men who show any disability, undue fatigue or distress. Such a course will not only lead to sympathy between the medical officer and the gymnastic instructor, but will also impress the latter with his responsibilities. In connection with this it is necessary to repeat once more, that the efforts of our Department will be futile in the absence of a thorough and comprehensive understanding of the principles of the system in vogue, its educational features, adaptability and means for ensuring progression; the differences between correct and incorrect positions, the amount and nature of physical work going on outside the gymnasium, and the regulations relating thereto. The acquirement of these essentials by the medical officer becomes all the more pressing when regimental officers lack such knowledge, and when the gymnastic instructor is not so efficient

as he might be. But this point need not be dilated on; its great importance to us, and to the recruit, is very obvious.

VI.—Conclusion.

The system briefly described above does not pretend to be perfect, but it is the best extant. It has many undecided issues, several of which come within the scope of the Army Medical Department. That the subject of physical training has a real scientific side, is as undoubted as the fact that, so far, few have explored it. But in this short space it has not been possible to give more than a mere outline of the subject; a list of some of the few books on physical training in the English language is therefore appended for the guidance of those wishing to make a further study of the question:—

"The Army Manual of Physical Training."

"The Naval Handbook of Physical Training." Two vols.

"The Principles and Practice of Educational Gymnastics; for the Use of Naval Officers and Instructors."

"Syllabus of Physical Exercises; for Use in Public Elementary Schools."

"School Gymnastics on the Swedish System," by Allan Broman.

"The Swedish System of Physical Education," by Theodora Johnson.

"National Physical Training; an Open Debate," edited by J. B. Atkins.

FURTHER REMARKS ON STAFF TOURS AND MANŒUVRES.

By Major F. J. WADE-BROWN.
Royal Army Medical Corps.

The following notes are intended to help those who have not, as yet, had the opportunity of attending Staff Tours and manœuvres, and to draw forth the criticism of those who have.

1. Appreciations.

An appreciation should invariably be written before an officer proceeds on a Staff Tour, and the following is an example of how an appreciation should be headed :—

"Appreciation
by the Director of Medical Services, Red Army,
March 5th, 1908.
(Ref. Map, Ordn. Survey, 4 miles, 1 inch)."

The appreciation should commence with a short description of the force to which the medical officer is attached. The strength of the force and its medical *personnel* can be extracted from "War Establishments, 1907-1908," but to facilitate this part of the work, tables are inserted at the end of this paragraph showing the strengths of divisions (a division being now the great fighting unit of the Army), and the *personnel* of the various medical units employed on active service. After the strengths have been stated, an appreciation should fully show: the medical preparations that have been made and will be made; where general and other hospitals are mobilised; where military and other hospitals already exist; where stores are to be found; what means there are and will be for the transport of sick and wounded; the number of sick that may be expected; how the number of cases may be influenced by the time of the year and by prevailing diseases, as well as the various other points mentioned in my last short article in the Journal for May, 1907.

An appreciation should be written most carefully for two reasons. In the first place, a good appreciation is a great help to the medical officer himself, and saves him the trouble of hunting, when time can least be spared, through numerous official books in order to find out the material he has to work with and to answer the numerous questions asked him by his General Officer Commanding; further, it

prevents him wondering where his various hospitals are mobilised, where the medical units are placed, and how his sick and wounded are to be disposed of. The second reason, of equal importance, is that the Director of a Staff Tour takes the greatest interest in the medical officers' appreciations (having been on the Directing Staff I know this for a fact), and often forms an opinion of the medical officers he has working with him from their appreciations alone.

"General" and "Special Ideas."

Many officers who have not as yet taken part in Staff Tours, do not know what "General and Special Ideas" mean. To explain these the General Officer Commanding London District has kindly given me permission to publish the General and Special Ideas of the last two London District Staff Tours. They will be found at the end of this article, and will also perhaps prove interesting to those officers who have attended Staff Tours elsewhere.

STRENGTH OF A CAVALRY DIVISION.

	Officers	Other ranks
Headquarters Staff	15	63
4 Cavalry Brigades	320	6,324
Headquarters Cavalry Divisional Artillery	8	17
2 Horse Artillery Brigades	38	1,338
Headquarters Cavalry Divisional Engineers	4	11
4 Field Troops	12	528
Cavalry Divisional Transport and Supply Column	26	528
4 Cavalry Field Ambulances	24	456
Total	442	9,265

STRENGTH OF A DIVISION.

	Officers	Other ranks
Headquarters Staff	16	78
3 Infantry Brigades	363	12,030
2 Squadrons Imperial Yeomanry	12	318
Headquarters Divisional Artillery	4	21
3 Field Artillery Brigades	75	2,847
1 Howitzer Brigade	18	528
1 Heavy Battery and Ammunition Column	6	242
Divisional Ammunition Column	20	866
Headquarters Divisional Engineers	4	11
2 Field Companies	12	426
1 Divisional Telegraph Company	2	40
Divisional Transport and Supply Column	23	446
Divisional Transport and Supply Park	12	457
3 Field Ambulances	30	723
Total	597	19,033

PERSONNEL OF MEDICAL UNITS, &c.

HEADQUARTERS OF ARMY.

	Officers	Other ranks
Attached to Staff of General Officer Commanding in Chief..	4[1]	4[2]
,, ,, ,, ,, ..	..	3[3]
Total ..	4	7

[1] Including a Director of Medical Services, two Assistant Directors of Medical Services, and one Medical Officer.

[2] Clerks. [3] Water duties.

CAVALRY DIVISION.

	Officers	Other ranks
Attached to Staff of General Officer Commanding	3[1]	3[2]
,, ,, ,, ...	..	2[3]
4 Cavalry Brigades (12 Regiments)	12	36[3]
3 Horse Artillery Brigades	2	6[3]
Headquarters Cavalry Divisional Engineers	1	..
4 Field Troops	..	8[3]
Cavalry Divisional Transport and Supply Column	1	5[3]
4 Cavalry Field Ambulances	24	456[4]
Total ..	43	516

[1] Including Administrative Medical Officer, one Medical Officer, and one Sanitary Officer.

[2] Clerks. [3] Water duties. [4] Including "Attached."

A DIVISION.

	Officers	Other ranks
Attached to Staff of General Officer Commanding	3[1]	5[2]
,, ,, ,, ...	..	2[3]
Total ..	3	7
3 Infantry Brigades (12 battalions)	12	60[3],[4]
3 Field Artillery Brigades..	3	12[3]
1 Howitzer Brigade	1	4[3]
1 Heavy Battery and Ammunition Column	..	2[3]
Divisional Ammunition Column..	1	4[3]
Headquarters Divisional Engineers	1	..
2 Field Companies	..	4[3]
1 Divisional Telegraph Company	..	2[3]
1 Divisional Transport and Supply Column	1	4[3]
Divisional Transport and Supply Park	1	2[3]
3 Field Ambulances	30[5]	723[6]
Total for Division ..	53	814

[1] Administrative Medical Officer, one Medical Officer, and one Sanitary Officer.

[2] Clerks. [3] Water duties.

[4] Also, in addition, Regimental Stretcher Bearers, two per Company, and Sanitary men.

[5] Includes three Quartermasters. [6] Including "Attached."

The medical arrangements for units for whom no medical officer is provided in war establishments are laid down as follows :—

(1) *Divisional yeomanry squadrons*—in charge of a medical officer to be detailed by the Administrative Medical Officer of the Division.

(2) *Headquarters of cavalry divisional artillery and of divisional artillery*—in charge of a medical officer with an artillery unit, to be detailed by the officer commanding cavalry divisional artillery or divisional artillery.

(3) *Cavalry divisional engineers and divisional engineers*—in charge of the medical officer with the headquarters of the cavalry divisional engineers or divisional engineers.

(4) *Headquarters of cavalry, mounted or infantry brigades and mounted brigade transport and supply columns*—in charge of a medical officer of a unit of the brigade, to be detailed by the brigadier-general commanding.

(5) *Heavy battery and ammunition column*—in charge of the medical officer with the howitzer brigade of division.

(6) *Army troops yeomanry squadrons*—in charge of the medical officer with the army troops transport and supply column.

(7) *Army troops engineers*—in charge of the medical officers with bridging trains.

(8) *Units on lines of communication*—in charge of a medical officer to be detailed by the Deputy Director of Medical Services with the headquarters of the lines of communication.

LINES OF COMMUNICATION.

	Officers	Nursing Sisters, &c.	Other ranks
Attached to Staff of General Officer Commanding Lines of Communication	3[1]	..	3[2]
Clearing Hospital (for 200 sick) ..	8[3]	..	80
Stationary Hospital (200 beds) ..	8[3]	A—17, B—36, C—*nil*	80
General Hospital (520 beds) ..	21[3]	A—43, B—91, C—*nil*	143
Ambulance Train (100 sick lying down) ..	2	2	16
Hospital Ship (220 beds) ..	6	9	26
Sanitary Section[4] ..	1	..	25
Sanitary Squad[5] ..	..	..	6
Advance Depôt of Medical Stores ..	1	..	5
Base Depôt of Medical Stores ..	2	..	8

[1] Including a Deputy Director of Medical Services, two Deputy Assistant Directors of Medical Services (one for Sanitary Services).

[2] Clerks. [3] Including a Quartermaster.

[4] Allotted to each base and each rail-head.

[5] One for each post on Lines of Communication: two squads for the advanced depôt, Medical Stores. Sanitary squads are attached to sanitary sections, as ordered.

2. Orders and Field Messages.

There are three varieties of orders :—

(*a*) Standing orders.

(*b*) Operation orders.

(*c*) Routine orders.

(*a*) Standing orders (*vide* "Combined Training," Field Service Regulations, Part 1) are issued to adapt existing regulations and local conditions, and to save frequent repetitions in operation orders.

(*b*) Operation orders include all orders dealing with operations in the field, such as marches, attack, defence, &c. As a rule these orders should embody the whole of the directions to each portion of the force taking part in the operations, so as to facilitate co-operation.

(*c*) Routine orders are the same as in peace time, and deal with matters of administration, discipline, interior economy, &c.

Field messages.—Instructions for writing field messages.

(1) Use A.B. 153 and envelopes A.F. C398.

(2) If message contains a reference to operation orders it should be headed " Ref. Op. orders by ————."

(3) Names of persons and places should be written in block type "DORCHESTER."

(4) In naming a unit from which a part has been excluded the unit should be named, and the words " less ————" appended: thus: " No. 2 Field Ambulance, less bearer subdivision of "A" Section, will proceed to ————."

(5) The hour 12 to be followed by "noon" or "midnight." Mention both days when describing a night: thus, 10/11 March.

(6) In mentioning places on a map, state distinctly what map is referred to.

(7) All messages must be clearly signed, rank, appointment and force being stated. A Field Message should close with the number of the message, the place from which it is sent, the date, the official title of person addressed, and the exact time of issue or dispatch.

Orders by Medical Officers.

At present medical officers do not write Operation Orders, perhaps I should say *ought not* to write Operation Orders. I know that on Staff Tours some do, but orders from the Staff medical officers are usually embodied in the Operation Orders of the General Officer Commanding in Chief, General Officer Commanding the Division, or the General Officer Commanding Lines of Communication. It

would perhaps lessen the pressure on the General Staff, and save time and trouble, if only matters of interest to combatant troops were entered in Operation Orders; while other orders concerning directly only medical units were issued by the Director of Medical Services, Deputy Director of Medical Services, or Administrative Medical Officer, in their capacity of officers of the General Staff. So long as an officer acting as Director of Medical Services, Deputy Director of Medical Services, or Administrative Medical Officer, on a Staff Tour, refrains from heading his orders "Operation Orders" he can seemingly issue what orders he likes; whatever he does will perhaps be criticised, but no one will definitely say whether his orders are issued in the right way or not.

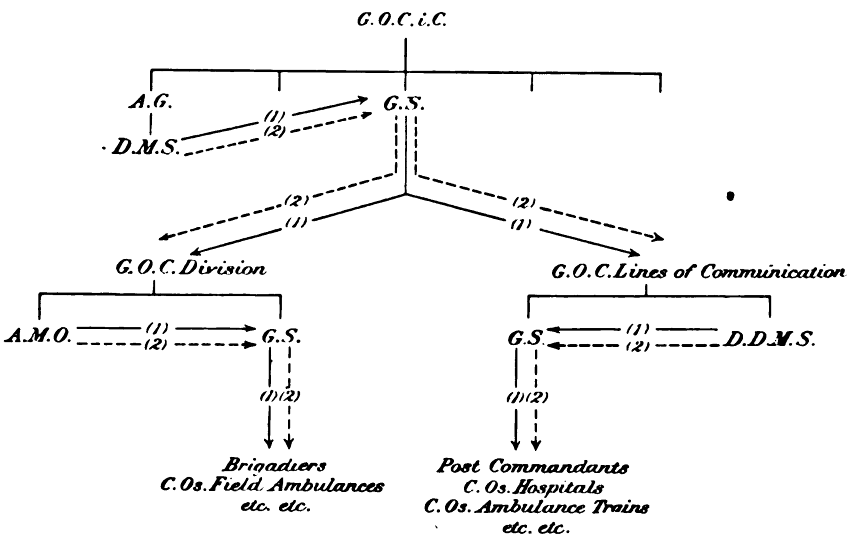
On Staff Tours and at manœuvres one often sees an Administrative Medical Officer selecting sites for dressing stations. Surely he would be much too occupied in real warfare to be able to do this. This small detail might perhaps with advantage be left to the officer commanding Field Ambulance as implied in Appendix X. Corps Manual, especially if the Field Ambulance were attached to, and working with, a brigade. Again, in the latter case, the orders from the Administrative Medical Officer are not always sent through the proper channels. I was once in charge of a field ambulance attached to a certain brigade, and my orders came straight from the Administrative Medical Officer telling me where to establish a dressing station, &c., but my Brigadier was not informed, and so the fact that a dressing station had been established did not appear in his orders. Had the action (a very severe one) been a reality, no one would have known where the dressing station was to be found, since I had no means of informing all the different units of the brigade. As the order in question concerned all the troops engaged, the Administrative Medical Officer's orders should have been sent, if sent at all, through the proper official channels, or the Brigadier informed. I have reason to believe, however, that on this occasion the General Staff were too busy to listen to anything the Administrative Medical Officer said, recommended, or wished done. I am also of opinion that other field units are situated as we are, and it is to invite criticism and to obtain further instruction that the before-mentioned suggestion is made for conveyance of orders. An explanatory diagram is appended at the end of this section.

There remain two points to be considered:—

(1) What should orders issued by Staff Medical Officers be called? Not Operation Orders, for that would lead to confusion.

Perhaps they might be termed "Special Orders," "General Orders," or "Medical Orders," or even "Special Orders (Medical)," "General Orders (Medical)," in case other branches of the Service had ultimately to adopt some such plan; or the word "Orders" might be left out and the title might be "Special Instructions," *vide* "Combined Training" 3 (5).

(2) Holy Writ has it that no man can serve two masters; therefore no Administrative Medical Officer can serve his Divisional Commander and the Director of Medical Services at one and the same time, but how can this be avoided?



3. The Nomenclature of the Field Ambulance and other Points Connected Therewith.

To officers, other than medical, the nomenclature of the field ambulance is most perplexing.

A "division" to the mind of a combatant officer is something of magnitude, a "section" something small. In a field ambulance there is not much difference in size between a "division" and a "section"; for, although a "bearer division" is nearly twice the size of a "section," a "tent division" contains approximately the same number of men. Endless confusion exists on this point.

An excellent Staff officer lately wrote "A half section of ——— will accompany———" There is no such thing as a "half section,"

and there is no doubt he meant a bearer sub-division of a certain section. It would perhaps be well if the word "division" could be done away with altogether and the sections numbered 1, 2 and 3, the present subdivisions being designated "subsections"; or the word "subsection" might even be abolished, and the subsections known only as such for intrinsic purposes to the section commanders. Again, there seems to be a mistake as regards the medical arrangements for an advance guard in "Combined Training, 1905."

In "Combined Training, 1902," p. 97, paragraph 8, it states "a bearer company, or a portion of one, with ambulances, should always form part of an advanced guard." In "Combined Training, 1905," p. 57, paragraph 7, the same statement is made, amended May 1st, 1907, the word "division" being substituted for "company." The Bearer Company of the old organisation formed its own dressing station, had its own water carts and forage carts; the bearer division of the field ambulance has probably none of these. Surely "a field ambulance or a section of one" is the suitable medical unit for an advance guard, and not a "division" unless the division carries in addition *personnel* and equipment for the formation of a dressing station.

Constituted as a field ambulance is, a section must be looked upon as a field ambulance in miniature. It is practically complete in every particular, and has its own water cart, forage cart and General Service waggons. On the line of march its road space is small, being about 110 to 120 yards.

The two subdivisions (tent and bearer) should always accompany an advance guard. A bearer subdivision should not be separated from its tent subdivision, with its dressing station, water cart and forage cart. These latter might at any moment be required when they were 7 or 10 miles away, beyond masses of troops, in rear of an ammunition column, or at the head of a second line of transport, difficult to get at by day, and much more so at night.

4. Clearing Hospitals.

A clearing hospital resembles a stationary hospital in many ways, but differs from it in being a mobile unit. One clearing hospital is mobilised for each division. Its mobility (its chief feature) depends on the amount of available transport. Experience on staff tours has repeatedly shown how quickly a clearing hospital has to be moved, or pushed forward, to the head of the line of communication, to relieve field ambulances of their wounded and

allow the latter units to rejoin their division or respective brigades. To facilitate transport arrangements each clearing hospital might, with advantage, be divided into two identical portions, called Sections A and B, or 1 and 2, with transport attached sufficient to move one section at a time. A clearing hospital is, indeed, a unit of the greatest importance in war time, but its successful working depends not only upon the rapidity with which it can relieve field ambulances of their sick and wounded, but also on the rapidity with which it can evacuate its own patients to rail-head or to the nearest stationary hospital. Every clearing hospital, therefore, should be provided with its own transport, including at least four motor ambulances.

5. Conclusion.

In conclusion, I would recommend that medical officers, especially senior medical officers who would in war-time hold positions on the various staffs, or be in command of large units, should use every endeavour to attend staff tours. Being brought into direct contact with senior combatant officers, one has an opportunity of exchanging ideas and of solving the important problems connected with medical and other organisations and administrations in war-time.

It would be well if the following officers could always take part in every staff tour of magnitude: A lieutenant-colonel on the directing staff to consult with the general, and correct work sent in; two officers (as senior as possible) with each army, one to act as Director of Medical Services and Deputy Director of Medical Services, the other as Administrative Medical Officer and Sanitary Officer (for billets, bivouacs, encampments, sites for hospitals, &c.). Since 1905, I have attended in various capacities three large staff tours and various manœuvres, and have come to the conclusion that one can learn far more in one week at a staff tour than in a year from books. Personally, I am looking forward to the next outing, when I know I shall meet combatant and non-combatant brethren who will always listen to what one has to say, thrash out with keen interest and with mutual advantage many knotty points, and help one to obtain a knowledge of organisation that staff tours, and staff tours only, can afford.

LONDON DISTRICT STAFF RIDE, MARCH 11TH TO 15TH, 1907

All references to Bartholomew's map, scale ½ inch to 1 mile.

GENERAL IDEA.

(1) ENGLAND, South of the THAMES, the KENNET and AVON Canal and the River AVON to BRISTOL forms the territories of two small States whose common frontier is the River ARUN, the WEY and ARUN Canal and the River WEY.

(2) The northern part of the Island of GREAT BRITAIN is an Independent Kingdom.

(3) The capital of BLUELAND is HASTINGS, the chief port and arsenal is DOVER. At BRIGHTON there is also an arsenal of considerable size.

(4) SOUTHAMPTON is the capital, chief port, dockyard and arsenal of REDLAND.

PORTSMOUTH does not exist, its harbour is merely a mud flat which is just covered with water at high tide.

(5) The ISLE of WIGHT belongs to REDLAND.

(6) For many years it has been the custom of a few BLUE fishermen to fish off the southern coasts of the ISLE of WIGHT, and the RED Government has never interfered because the number of BLUE fishing vessels was so small that no harm was done, but lately two large companies have been formed in BLUELAND with many fishing boats, and the RED fisher folk have found themselves in danger of being crowded out. In consequence, the RED Government has notified the BLUE Government that it can no longer allow any foreign vessels to fish in her territorial waters, and the BLUE boats were warned off. BLUE, feeling that a custom of such long standing gave her a right to the advantages which she had so long enjoyed, proposed going to arbitration, but RED refused this suggestion, and about the middle of February she seized about a dozen BLUE boats which had disregarded all warnings and which had persisted in fishing in the prohibited water.

The result of this action was an immediate outcry in BLUELAND, and the release of the captured boats was instantly demanded. As this demand was not complied with, war was declared.

(7) On February 28th a severe naval engagement was fought off NEW SHOREHAM and the RED fleet withdrew to SOUTHAMPTON badly mauled, but the BLUE fleet had also sustained serious damage, and after pursuing the RED fleet as far as SPITHEAD returned to DOVER.

(8) The land forces of the two countries are as follows :—

BLUE.	I. Division,	peace station	WEST GRINSTEAD STATION.
	II. ,,	,, ,,	BRIGHTON.
	III. ,,	,, ,,	TUNBRIDGE WELLS.
	I. Cavalry Brigade	,,	HURSTPIERPOINT (7 miles north of BRIGHTON).

BLUE has no Auxiliary troops.

RED.	I.	Division, peace station	WINCHESTER.
	II.	,, ,, ,,	BASINGSTOKE.
	III.	,, ,, ,,	EXETER.
	I.	Cavalry Brigade ,,	WINCHESTER.

RED has recently raised a force of Auxiliaries approximating to about two Divisions (of two Brigades each); but it is known that the mobilisation arrangements of this force have been neglected on the score of finance.

NOTE.—The composition of the Regular Divisions of both the RED and the BLUE Armies is as detailed in the Special Army Order, dated War Office, January 1st, 1907, Appendix A.

SPECIAL IDEA (BLUE).

(1) At 10 p.m. on March 11th, the I. BLUE Division has completed its mobilisation and will be ready to move at any time after 5 a.m. on March 12th.

The 1st Brigade is at PARTRIDGE GREEN STATION.

The 2nd Brigade is at WEST GRINSTEAD PARK.

The 3rd Brigade is at SHIPLEY.

Divisional troops are at WEST GRINSTEAD STATION.

The Cavalry Brigade has just arrived at WEST CHILTINGTON, and has patrols watching the crossings of the River ARUN (which are held by RED Cavalry) from BILLINGSHURST to the Sea.

The II. Division at BRIGHTON has not completed its mobilisation and cannot move till midnight on March 13th—14th, owing to the delay in sending boots and harness from HASTINGS, where these articles have been stored in peace time owing to lack of storage accommodation at BRIGHTON.

The III. Division is at TUNBRIDGE WELLS and will complete its mobilisation at midday on March 13th, boots and harness having to be sent from HASTINGS in this case also.

(2) A secret Agent reports that large bodies of troops left WINCHESTER, marching east, early on the morning of March 11th. It is believed that the RED (EXETER) Division will not finish its mobilisation before March 14th or 15th. Several officers have been sent by motor car and motor bicycle to reconnoitre towards BASINGSTOKE. Only one officer has returned yet; he reports having seen a great deal of dust rising from the road over the high ground near HERRIRD about 10 a.m. on March 11th.

(3) Rolling stock is scarce. It is not probable that any will be available for troop movements before March 15th. It is believed that RED is at the same disadvantage.

SPECIAL IDEA (RED).

(1) On the evening of March 11th the RED troops have arrived at the following places after marching from WINCHESTER and BASINGSTOKE.

I. Division:—

1st Brigade at ROGATE.
2nd Brigade at SHEET.
3rd Brigade at PETERSFIELD.
Divisional troops at PETERSFIELD.

II. Division:—

4th Brigade at LIPHOOK.
5th Brigade at EMPSHOT.
6th Brigade at HOLYWATER (2 miles N.W. of LIPHOOK).
Divisional troops at SELBORNE.

The Cavalry Brigade is at BARLAVINGTON (4 miles South of PETWORTH) and is holding the crossings of the River ARUN from BILLINGSHURST to the sea.

The main road bridge crossing the River ARUN between BILLINGSHURST and WISBOROUGH GREEN has been blown up.

(2) The III. Division is still at EXETER, and cannot complete its mobilisation till March 14th.

(3) RED is also mobilising 3 Divisions (of 2 Brigades each) of Auxiliary troops at SALISBURY and SHERBORNE, but these cannot be ready to take the field for at least a fortnight.

(4) It is known from secret information obtained before the outbreak of war that the I. BLUE Division and the BLUE Cavalry Brigade can be quickly mobilised, but that owing to defective arrangements the II. and III. BLUE Divisions will be from two to three days longer in completing their mobilisation.

A secret agent who has been at WEST GRINSTEAD has telegraphed to SOUTHAMPTON that the 1st BLUE Division expected to be ready to move on March 12th.

(5) Rolling stock is very scarce, none will be available for troop movements until March 15th; it is believed that BLUE labours under the same disadvantage.

LONDON DISTRICT STAFF TOUR, MARCH 16TH TO 20TH, 1908.

All references to O.S. Map, scale 2 miles to 1 inch, Sheet 78; O.S. Map, scale 4 miles to 1 inch, Sheets 19 and 23.

GENERAL IDEA.

REDLAND (ENGLAND and WALES) and BLUELAND (IRELAND) are two independent States.

For some years BLUELAND and REDLAND have been on bad terms with one another. BLUELAND has a fleet that is far stronger than that of

REDLAND, and for the last 100 years her naval supremacy has been unchallenged, Of late years REDLAND has made great efforts to put herself on more equal terms with BLUELAND as regards her navy. Towards the end of 1907 the RED Government, with a view to encouraging a larger portion of the population to take to a seafaring life, and so to have a greater number of men accustomed to the sea as possible reserves for her fleet, passed a law restricting all RED coasting trade to RED-owned and RED-manned vessels.

This measure created great excitement in BLUELAND, for a large portion of the carrying trade between RED ports had been in the hands of BLUE shipowners for many years. The BLUE Government remonstrated at what they considered an unjust and unfriendly measure. Diplomatic negotiations were carried on, but neither side seemed to have much hope that the quarrel would permit of an arrangement being arrived at which would be satisfactory to both parties, and the mobilisation of the armed forces of both countries was being proceeded with.

This was the state of affairs when, on March 10th, the BLUE fleet made a sudden attack on the RED fleet off SPITHEAD. The RED ships, taken by surprise and outnumbered, were quickly overpowered. More than half their number being sunk, the remainder took refuge in PORTSMOUTH HARROUR, which is now being closely blockaded.

On March 15th a BLUE force was landed in the BRISTOL CHANNEL near CLEVEDON, and seized BRISTOL, securing quays, wharves, &c., intact, and immediately began to disembark troops from a fleet of transports.

The military strength of the two nations are is follows:—

BLUELAND—7 Infantry Divisions.
1 Cavalry Brigade.
REDLAND—5 Infantry Divisions.
1 Cavalry Brigade.

The RED mobilisation centres are as follows:—

Cavalry Brigade, NEWBURY.
1st Infantry Brigade, NEWBURY.
1st Infantry Division (less 1 Infantry Brigade), READING.
2nd Infantry Division, READING.
3rd Infantry Division, SOUTHAMPTON
4th Infantry Division, DORCHESTER.
5th Infantry Division, FARINGDON (BERKS).

READING is the capital of REDLAND, and is the chief arsenal and manufacturing town in the country. LONDON is a town of no special importance. There is a smaller arsenal at MARLBOROUGH, which town is only second in importance to READING, and large stores of all kinds have been accumulated there.

The coast of REDLAND is rockbound, and BRISTOL is the only port which BLUE is likely to be able to seize.

The railways are all of very narrow gauge, and are not available for the transport of troops, but can be used to bring up supplies, ammunition, &c.

N.B.—The troops of both countries are organised as in War Establishments, except that a Cavalry Brigade has the following extra troops :—

Artillery as for a Mounted Brigade.
1 Field Troop R.E.
1 Cavalry Field Ambulance.
1 Co. Cavalry Divisional T. and S. Column.

SPECIAL IDEA (BLUE).

At 6 p.m. on March 16th, the following BLUE troops have already been landed at BRISTOL: 1 Cavalry Brigade, 1 Infantry Division. The 2nd and 3rd Infantry Divisions will have completed disembarkation by 9 a.m., March 17th.

The 4th Division is still in BLUELAND, and cannot be disembarked till the afternoon of Thursday, March 19th.

The 5th Division will be forty-eight hours later in arriving owing to BLUE not having transports enough to convey more than 1 Cavalry Brigade and 3 Infantry Divisions in one trip. The 6th and 7th Divisions will not complete mobilisation for ten days.

The 1st Brigade and 1st R.F.A. Brigade (1st Division) have been detailed to garrison BRISTOL.

The BLUE G.O.C.-in-C. has the following information about the enemy:—

Mobilisation of the 1st and 2nd RED Divisions and the RED Cavalry Brigade will probably be completed during the night of March 16th—17th, but the 3rd and 4th Divisions will not be mobilised till the night of 17th—18th, and the 5th Division will probably be twenty-four hours later still.

At 6.30 p.m., March 16th, the G.O.C. 1st BLUE Division, who is also in possession of the above information, receives the following wireless telegram from G.O.C.-in-C. :—

"The 1st Division (less BRISTOL Garrison) will move East under your Command as soon as possible, the 2nd and 3rd Divisions will follow you as soon as they are disembarked and are put under your orders; the Cavalry should push on to MARLBOROUGH, and if possible destroy the stores accumulated there. Delay the advance of the RED force from READING as much as you possibly can, and, if they move West before the remainder of the RED Army joins them do not lose an opportunity of defeating them. This ship has lost a propellor, and my arrival is delayed. I trust to your energy and judgment. You will be in supreme command till my arrival."

SPECIAL IDEA (RED).

The RED force will complete its mobilisation as follows :—

Cavalry Brigade, 1st and 2nd Divisions, midnight, March 16th—17th.

3rd and 4th Divisions, midnight, March 17th—18th.

5th Division, 4 a.m., March 19th.

The RED C.-in-C. has the following information :—

(1) The transports already seen in the BRISTOL CHANNEL are believed to contain about 1 Infantry Division and a Cavalry Brigade, and began to disembark troops during the night of 15th—16th.

(2) It is known that BLUE cannot collect enough transport to carry more than a Cavalry Brigade and 3 Infantry Divisions in one trip.

(3) Only one Division or Cavalry Brigade can be disembarked at one time at BRISTOL, and it is believed that each Division will take about eight hours to disembark.

The RED Government has ordered the RED C.-in-C. to push on as quickly as possible with Cavalry Brigade and 1st and 2nd Divisions as soon as these have completed their mobilisation, so as to safeguard MARLBOROUGH from any attack which may be made on it by the BLUE troops, already landed at BRISTOL; and has also impressed on him the necessity, for political reasons, of keeping the country East of DEVIZES-CALNE clear of the enemy's troops.

A FEW POINTS BEARING ON THE EARLY DIAGNOSIS OF SOME "SURGICAL" ABDOMINAL LESIONS.

By Captain J. CHURTON.
Royal Army Medical Corps.

I HAVE been led to write these few lines by having recently seen unfortunate results occur, owing to failure in recognising some "surgical" abdominal lesions until these had fully assumed their text-book characteristics. Delay in diagnosis, needless to say, is often apt to be most disastrous. Unfortunately few of these grave conditions become typical, so called, until they are almost beyond the stage when surgical interference can hope for success. It is for this reason I wish to emphasise what are, in my opinion, some of the most important early signs, from the point of view of diagnosis.

The initial stage in most of these cases is shock, the result of a sudden impression on the splanchnic nerves. This condition is rarely, if ever, absent; but may be so slight, even though the particular lesion is extremely severe, that it is occasionally completely overlooked. As an instance of this I may mention a case which came under my notice some two years ago. This was a man who, whilst playing football, received a blow in the abdomen from the ball. It was towards the end of the game, otherwise I almost believe he might have resumed playing; instead, after lying down for a few minutes, he got up and walked to his quarters, a distance of about half a mile. This was on a Saturday afternoon; all Sunday he remained indoors, not, as he thought, unwell enough to go to hospital, though this was close at hand; in fact, it was not until the Monday afternoon that he reported sick. His condition then was as follows: Temperature 101° F., pulse 100, respiration 25; general appearance good, by which I mean he did not look particularly ill; heart and lungs normal; abdomen rigid and immobile, with general tenderness, particularly over the region of the right iliac fossa; percussion note generally hyper-resonant; no obliteration of liver dulness. An hour later I saw the patient. In the meantime he had been given an enema, the bowels having been confined for some days, with a good result and no blood in the stool. His condition was then unaltered, except that the pulse and respiration had increased. It was agreed that an exploratory operation was the

only thing, but with regard to diagnosis some difference of opinion existed. He was therefore anæsthetised and the abdomen opened in the region of the right rectus muscle. A rent in the ilium close to the ilio-cæcal valve, about an inch long, was easily discovered. This was closed, and the abdomen cavity cleansed as far as possible, drainage tubes being afterwards inserted. Shock followed the operation, from which patient appeared to recover, though he eventually died from toxæmia some little time later.

Another illustrative case of insignificant shock, if I may so term it, occurred only the other day. This was a boy whom I was asked to see some eight days after he had been admitted to hospital. He was then undoubtedly suffering from acute general peritonitis. His abdomen was rigid, immobile and tender all over; percussion note hyper-resonant, except in the flanks, which were dull. The bowels were costive, though they had been relieved from time to time by enemata. On admission the temperature was 103·5° F., at about which height it remained until the evening of the fifth day, when during the night it fell 2°, and the patient complained of some abdominal pain and was restless. These later facts I only ascertained afterwards, as their significance at the time was apparently not recognised. The temperature having risen again to its former height and the pain having almost disappeared, he was transferred on the seventh day as a possible case of enteric fever.

On the eighth day, his general condition being good, I decided to operate, the indication being acute general peritonitis. On making an exploratory incision immediately to the right of the middle line just below the umbilicus, sero-sanguineous fluid at once welled up into the wound, the intestines were found matted together with recent lymph, and, whilst endeavouring to ascertain the cause a collection of pus was discovered in the recto-vesical pouch, which seemed to be shut off from the rest of the peritoneal cavity. The surrounding intestines were next packed off with gauze and the pus sponged out. Nothing to indicate the cause of this suppuration could be discovered, so a drainage tube was inserted and the wound partially closed. The patient recovered from the shock of the operation, but subsequently died from exhaustion some two days later, the result, no doubt, of toxic absorption from the paralysed intestines. At the *post-mortem* examination the case proved to be one of enteric fever, in which an ulcer had perforated the ilium, some distance above the ilio-cæcal valve.

Now, with regard to diagnosis, I am of opinion that shock plays

a most significant part, brought about, as it probably is in these cases, by influences produced upon the sensitive splanchnic nerves. It may be more or less insignificant in its effect, still its presence, or the history of its presence, should none the less be looked upon as a most important sign, particularly when subsequently backed up, as it usually is, by an increase in the pulse-rate, pain, general or local, and rigidity. These later points should be looked for at once, otherwise the misleading intermediate stage arises during which the patient either appears so well that at first sight it seems almost impossible for anything serious to be the matter, or he lapses back for a time into his former state.

There are two grave points in connection with this subject about which I wish to make a few remarks. These are, firstly, the facies hippocratica, or abdominal facies graphically described by Hippocrates, and so impressive to the student of medicine that its lasting effect is unfortunately wonderful. I say "unfortunately," because the importance of these abdominal diseases is too often not recognised, or at any rate not thoroughly realised, until such times as this particular aspect has become manifest, by which time, very frequently, the patient's chances of a successful issue at the hands of the surgeon have undergone material diminution. There can be no doubt as to the importance of this indication when present; it is, however, much too often absent to be looked upon as a reliable early sign of a grave abdominal lesion. Too often have I seen patients with these abdominal conditions appear as though in perfect health. Secondly, flocculent or stercoraceous vomiting: I am afraid this is still occasionally waited for in cases of intestinal obstruction, in order to definitely clinch the diagnosis. Yet, if it were generally realised that this symptom depends upon bacterial activity in an over-distended bowel and therefore very frequently does not appear for some time, the unnecessary delay, which means so much in these cases, would less seldom occur. Quite recently a case was brought under my notice of a patient who had undoubtedly had acute intestinal obstruction for some days without its being recognised, and I cannot help feeling that the delay was caused simply by the fact that the patient neither exhibited the facies hippocratica nor had fæcal vomiting until very late.

Now with regard to the diagnosis of intestinal obstruction, which is perhaps not always as easy as it appears to be from the text-book descriptions. If I may be excused for dogmatising, I would like to say just a word or two on the subject of enemata in these cases. It not unfrequently happens that most of the signs and

symptoms indicative of complete obstruction clear up after the administration of enemata. On the other hand, certain cases exhibiting very imperfectly the characters of complete obstruction can often only be recognised as such after enemata have been given; and in any case, if the latter fail, the question of surgical interference should be most seriously considered. Therefore, when in doubt, I would advise the giving of enemata as a simple test. They are safe and reliable if properly administered. Enemata of soap and water mixed with castor oil and turpentine are to be recommended as being very efficacious.

FURTHER NOTES ON SURGICAL TECHNIQUE.

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In the February, 1907, number of the Journal, and also in the January number of this year, were published "Some Notes on Surgical Technique as Practised at the Military Hospital, Curragh." I have continued work on the same lines, and the results are, I think, of general interest. My chief object in publishing these Notes is to emphasise the fact that aseptic surgery can be conducted at little expense and without elaborate apparatus. Given aseptic dressings and gloves, which to my mind are essential, an operation ought to be as safely performed in a barrack-room as in a hospital theatre.

All sterilising of dressings, &c., in the Curragh Military Hospital is now done in the disinfector. This is much more convenient and much less likely to get out of order than the high-pressure autoclave supplied to theatres. I find that the "drums" for sterilising towels, &c., easily become damaged and then cease to be air-tight. I am, therefore, now using instead old biscuit tins. These answer the purpose quite as well. No elaborate precautions are taken in the disinfection of the hands. They are simply washed for a few minutes in hot water. I do not attempt to make them surgically clean, but rely entirely on gloves for protection. The more one uses gloves, the more used to them one gets, and the less likely one is to puncture them. Septic cases are operated upon in the same theatre as aseptic, but no orderly who has charge of a septic case is allowed to have anything to do with an aseptic case, and *vice versâ*. The same rule applies to sisters, and, as far as possible, to medical officers. The latter, however, invariably wear gloves when dressing cases.

I have, for some time, been convinced that the chief source of contamination is the patient's own skin. One can insure sterility of instruments, dressings, &c., but I have not yet found a satisfactory means of guarding the edges of the wound. At present I am using dental dam. This is better than butter-muslin as it is non-absorbable, but it is rather difficult to adjust. That skin varies in its power of being rendered aseptic, according to the region of body, is well known. Lockwood, in his article "On Chemicals in Aseptic Surgery" in the *British Medical Journal* for February 8th, 1908, says: "The skin of the limbs afforded the highest proportion

of asepsis, then the skin of the abdomen (1 : 7 septic), and then the groin (1 : 3 septic)." This skin infection has had a marked effect on our results; the sutures proving sterile much more frequently in the case of operations on the extremities than in groin cases.

A word of explanation of the tables is desirable. They were compiled from cases operated upon consecutively, and all healed by primary union. I have divided them into two groups, viz., "Operations in the Region of the Groin" and "Operations on the Extremities." Blank spaces mean that no experiment has been made. An agar culture is made, in a watch-glass, from the skin both before and after washing on the day previous to operation, and the same is done after washing on the day of operation. The watch-glass is pressed firmly on to the skin. The number of colonies refers to the number found on the watch-glass, which acts as a gauge. The upper and under surfaces of the guard are tested in a similar manner at the end of the operation. At the end of the operation a couple of platinum loopfuls of the water used for dipping the hands in during the operation are taken, and inoculated into broth. On the removal of the sutures, the *whole* of the sutures in each case are inoculated into broth. This is, of course, a very rigorous test. In only two cases out of nine was the skin found to be sterile before washing. In no case was the skin found to be sterile after washing on the day of operation. In eleven cases out of twenty-one the water was found to be sterile at the end of an operation. Micro-organisms detected in the water should be a fair indication of those likely to be found on the gloves. The test is, however, but a rough one, as such a small quantity of water (only two platinum loopfuls) is taken in each case.

Turning now to the skin-guard: In examining the results of the upper surface cultures it will, I think, appear evident, as might be expected, that there is no appreciable difference between the results obtained in Table I. and Table II. It is also clear that any micro-organisms found on the upper surface may equally well be found in the wound—they are both exposed to contamination from without. On the other hand, the results of "under-surface" cultures are more satisfactory in Table II. than in Table I. The cases examined are too few to be conclusive, but they rather point to the fact that contamination of the sutures proceeds from the skin of the patient.

With regard to the sutures: Taking the whole series of fifty-seven cases, nineteen, or 33·3 per cent., proved to be sterile. Of the thirty-five groin cases examined, only seven, or 20 per cent., were

sterile, whereas in the twenty-two operations on the extremities thirteen, or 59 per cent., were sterile.

Many of the organisms found were probably non-pathogenic, and are, I think, judging from clinical results, surgically unimportant. If we exclude such organisms as *Bacillus subtilis* and staphylococci which do not liquify gelatine—not the ordinary *Staphylococcus, albus*, which may cause suppuration—the percentage of sterile and harmless cultures works out at about 58. To aim at excluding all organisms involves much expense and difficulty. After all, if one can get rid of the probable pus-forming organisms, it is all that one need try for.

Lately I have been using a mouth-guard. It is certainly desirable, but not, I think, essential. I have not, as yet, used a cap for the head. It may be asked why I have not long ago adopted such precautions. My answer to this is, that the whole object of these experiments has been to simplify technique, and I avoid doing anything which has not in my own practice been found to be essential. The skin of the patient is, as I have said, in my opinion, the important thing. I treat this very gently, and do not scrub it more than is absolutely necessary. If one scrubs the skin too much one probably brings to the surface micro-organisms which have been lying dormant in the deeper layers. Whether one can reach them by means of chemicals is a different matter, on which I do not propose to touch. Personally, I never use any chemicals whatever.

In conclusion, I wish to say that I have received the greatest assistance from Private Teesdale-Buckell, R.A.M.C. laboratory attendant, in working out the various bacteriological tests.

TABLE I.—OPERATIONS IN REGION OF THE GROIN.

Number and Operation	Skin			Water	Guard		Sutures	Remarks
	Before washing, previous day	After washing, previous day	After washing, day of operation	After operation	Upper surface	Under surface		
1 Hernia	.. ..	.. ..	.. ..	.. .. ..	*S. aureus*	Sterile after 5 days	—	—
2 ,, ...	.. ..	.. ..	.. ..	.. .. ..	Staphylococcus (variety not differentiated) in 24 hours	.. .. ..	Staphylococcus (variety not differentiated) in 24 hours	—
3 ,, ...	.. ..	.. ..	.. ..	.. .. ..	Sterile after 6 days	Four colonies of *S. albus*	*S. albus*	—
4 ,, ...	.. ..	.. ..	.. ..	.. .. ..	Numerous colonies after 24 hours, staphylococcus and *B. subtilis*	Same as upper surface	Staphylococcus & streptococcus	—
5 Varicocele ..	.. ..	.. ..	.. ..	.. .. ..	Six colonies after 4 days, streptothrix	Seven colonies after 48 hrs., streptoth.	*S. albus* in 3 days	—
6 Strangulated hernia	.. ..	.. ..	.. ..	Streptococci after 48 hours	Two colonies of *aureus* in 24 hours	.. .. ..	*S. aureus* in 24 hours	—
7 Hernia	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	,, ,,	—
8 Varicocele ..	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	,, ,,	—
9 ,, ...	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*S. albus* in 3 days	—
10 Hernia	.. ..	.. ..	.. ..	Sterile after 5 days	Growth in 48 hrs. Three colonies of *albus*, four streptothr., two *B. subtilis*, three *aureus*	Countless colonies in 24 hrs., *albus* & *aureus* isolated	*S. albus* after 3 days	—
11 ,, ...	.. ..	.. ..	.. ..	Slight growth of *S. citreus* after 48 hours	Numerous colonies of *citreus* in 48 hrs.	Three colonies of *citreus* in 48 hrs.	*B. subtilis* in 48 hours	—
12 ,, ...	.. ..	.. ..	.. ..	Sterile after 4 days	Five *citreus*, four *albus* in 48 hours	Twenty-five colonies of *albus*	Rod-shaped bacilli	—
13 ,, ...	.. ..	.. ..	.. ..	,, ,,	Ten colonies *albus* in 3 days	**In 3 days, sixteen *citreus*, two *albus*,** two *aureus*	*B. subtilis* in 48 hours	Rubber guard used for first time.
14 ,, ...	.. ..	.. ..	.. ..	*Bacillus subtilis* after 3 days	Numerous colonies of *albus* in 48 hrs.	Same as upper surface	Slight growth of *albus* and *citreus*	—
15 ,, ...	.. ..	.. ..	.. ..	Streptothrix after 3 days	Numerous colonies in 24 hours, not differentiated	,, ,,	*B. subtilis* in 3 days	—

16	Varicocele ..	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*S. aureus* after 48 hours	Wound healed by pr. union except at upper corner, where there was a slight watery discharge.
17	,, ...	.. ..	.. ..	.. ..	*S. citreus* in 3 days	Growth in 24 hrs., two *aureus*, numerous *citreus*	After 4 days, two *citreus*, four *albus*	Sterile after 7 days	—
18	Hernia	.. ..	.. ..	.. ..	*S. albus* in 4 days	Growth in 24 hrs., three *citreus*, eight *albus*	Growth in 24 hrs., seventeen *aureus*, four *albus*, one *citreus*	Slight growth of *B. subtilis*	—
19	,, ...	.. ..	.. ..	.. ..	Sterile after 7 days	One colony of *aureus* after 7 days	One colony of *albus* after 7 days	*S. albus* in 3 days	—
20	,, ...	.. ..	.. ..	.. ..	Sterile after 8 days	*S. citreus*	*S. citreus*	*S. albus*	—
21	,, ...	.. ..	.. ..	.. ..	Streptothrix after 3 days	Yellow and white staphylococci not liquef. gelatine	Same as upper surface	Sterile after 4 days	—
22	,, ...	.. ..	.. ..	.. ..	*S. albus* in 4 days	.. .. ..	.. .. ..	*S. citreus* in 5 days	—
23	,, ...	Yellow colonies of staphylococci not liq. gelatine	Yellow staphylococci not liquefying gelatine	Yellow staphylococci not liq. gelatine	.. .. ..	*Citreus*	—	—	—
24	,, ...	Slight growth of staphyloc. not liq. gel., and streptoc.	.. ..	Two colonies of a staphylococcus not liq. gelatine	.. .. ..	Sterile after 4 days	.. .. ..	Sterile after 6 days	—
25	,, ...	In three days a yellow staphylococcus not liq. gelatine	After three days *Staphylococcus citreus* & *albus*	*S. citreus* ..	Sterile after 5 days	Yellow staphylococcus not liquefying gelatine	.. .. ..	*B. subtilis* in 3 days	—
26	,, ...	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*Micrococcus tetragenes* and *B. subtilis* after 3 days	—
27	Varicocele ..	.. ..	.. ..	Three colonies of yellow staphylococ. not liq. gelatine	.. .. ..	Fifty colonies of yellow staphylococcus not liquefying gelatine	Thirty colonies of yellow staphylococcus not liquefying gelatine	—	—
28	Hernia	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	Sterile after 10 days	—
29	Varix ligatured at saphenous opening	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*Aureus*, *albus*, and *citreus*	—

TABLE I.—OPERATIONS IN REGION OF THE GROIN—*Continued.*

Number and Operation	Skin: Before washing, previous day	Skin: After washing, previous day	Skin: After washing, day of operation	Water: After operation	Guard: Upper surface	Guard: Under surface	Sutures	Remarks
30 Hernia	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*Cereus*, *albus* ..	—
31 ,, ...	.. ..	Numerous colonies of *S. albus* and *citreus*	Two colonies of yellow staphylococ. not liq. gelatine	.. .. ..	.. .. ..	.. .. ..	Sterile after 5 days	—
32 ,, ...	Sterile ..	*S. albus* ..	Yellow staphylococcus not liq. gelatine	*B. subtilis* ..	White and yellow staphylococci not liquefy. gelatine	White and yellow staphylococci not liquefy. gelatine	*B. subtilis* ..	Mouth - guard used for first time.
33 Varicocele ..	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	White staphyl. not liquef. gelatine	—
34 Hernia	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*S. albus*	—
35 Varicocele ..	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	White staphyl. not liquef. gelatine	—
36 Hernia	Sterile ..	*S. albus*	.. ..	*B. subtilis* ..	White and yellow staphylococci not liquefy. gelatine	White and yellow staphylococci not liquef. gelatine	*B. subtilis* ..	—
37 ,, ...	*S. albus* ..	*S. albus* and *citreus*	.. ..	.. .. ..	One colony *S. citreus*	Sterile after 7 days	Sterile after 7 days	—
38 ,, ...	.. ..	.. ..	.. ..	Sterile	Yellow staphyl. not liquefy. gelatine	*Aureus* and *albus*	,, ,,	—

TABLE II.—OPERATIONS ON THE EXTREMITIES.

Number and Operation	Skin: Before washing, previous day	Skin: After washing, previous day	Skin: After washing, day of operation	Water: After operation	Guard: Upper surface	Guard: Under surface	Sutures	Remarks
1 Removal of cartilage	.. ..	.. ..	.. ..	.. .. ..	One colony after 48 hours, *B. subtilis*	Sterile after 7 days	Sterile after 5 days	—
2 Excision of varix	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*S. albus* in 5 days	—
8 Removal of articular cartilage	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	Sterile after 5 days	—

4	Removal of articular cartilages	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*S. albus* after 48 hours	—
5	,, ,,	.. ..	.. ..	.. ..	Sterile after 5 days	Two colonies of *citreus*	Eight *albus*, three *citreus*	Sterile after 5 days	—
6	,, ,,	.. ..	.. ..	.. ..	,, ,,	Fifty colonies of *S. albus* in 4 days	Fourteen colonies of *S. albus* in 4 days	*S. citreus* ..	Slight synovitis of knee at time of operation.
7	,, ,,	.. ..	.. ..	.. ..	,, ,,	After 3 days, four *albus*, one *aureus*	After 3 days, two *albus*, seven *citreus*	Sterile after 5 days	—
8	Removal of varix	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	*B. subtilis* in 48 hours	—
9	Removal of articular cartilage	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	Streptothrix in 3 days	
10	,, ,,	.. ..	.. ..	.. ..	*B. subtilis* in 48 hours	One *albus*, four *citreus* in 48 hours	One colony of *citreus* in 48 hours	A diplococcus in 48 hours	—
11	,, ,,	.. ..	.. ..	.. ..	,, ,,	Nine *citreus*, two *albus* in 4 days	One colony in 18 hours, *albus*	*Citreus* and *aureus* after 48 hours	—
12	,, ,,	.. ..	.. ..	.. ..	,, ,,	Four colonies *albus*, two *citreus* in 48 hours	Nineteen *albus* in 48 hours	Diplococci, *S. albus* and *B. subtilis* in 48 hours	—
13	,, ,,	.. ..	.. ..	.. ..	.. .. ..	Countless colonies of *citreus*, one *aureus* in 4 days	One colony *albus* in 24 hours	Sterile after 7 days	—
14	,, ,,	.. ..	.. ..	.. ..	.. .. ..	Seven *albus*, three *aureus* in 24 hrs.	Seven colonies in 5 days, *citreus* and *albus*	,, ,,	—
15	Wiring metacarpal bone	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	,, ,,	—
16	Removal of varix	.. ..	.. ..	*Micrococcus tetragenes*	.. .. ..	.. .. ..	.. .. ..	,, ,,	—
17	,, ,,	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	,, ,,	—
18	Removal of cartilage	Numerous colonies, *aureus* and *albus*	One *aureus*, one *albus*, two *citreus*	*Citreus* and *albus*	Sterile after 5 days	Staphylococci not liquef. gelatine	Sterile after 10 days	Sterile after 10 days	—
19	Removal of exostosis of tibia	Countless colonies of *citreus*	Two colonies *albus*	*S. albus* ..	.. .. ..	.. .. ..	.. .. ..	Sterile after 7 days	
20	Amputn. of finger	.. ..	.. ..	.. ..	.. .. ..	.. .. ..	.. .. ..	,, ,,	—
21	Removal of cartilage	Staphylococcus not liquefying gelatine	Staphylococcus not liquefying gelatine	One colony of staphyl. not liq. gelatine	.. .. ..	*S. citreus* and *B. subtilis*	One colony of *B. subtilis*	,, ,,	—
22	Removal of varix	.. ..	.. ..	.. ..	.. .. ..	Sterile after 7 days	Sterile after 7 days	*B. subtilis* ..	—

NOTES ON THE NEW GENEVA CONVENTION.

By Lieutenant-Colonel J. D. F. DONEGAN.
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To anyone who ever chanced to serve in the field under the old Geneva Convention of 1864, the perusal of the new and more explicit article dated December 31st, 1906, now published in the 1907 edition of "Military Law," p. 250, must be a source of joy and gratification.

As I have previously stated in an article in our Journal wherein I gave my personal experiences, the old Convention was nothing more or less than a tabulated list of things which a commander of a force in the field could do, if he wished, down to giving his adversaries-in-arms plum pudding on Christmas day. All the trouble commenced when it became a question of making him do what he did not wish to. At the start of the South African War, 1899 to 1902, the knowledge of the rules and articles of the Geneva Convention amongst British commanders was, to say the least of it, not thorough; while, in contrast, the Boers knew the rules of the Convention as well as a racing Parsee knows the rules of the Western India Turf Club. The latter, when he cannot win a race fair and square, is always prepared to get the prize with the assistance of his brains and the regulations. A gentleman who indulges in the sport of kings and does not know the rules, no matter how good his horses may be, does not usually meet with success; and in the game of war things are not much different.

One must be sceptical indeed if one can find flaws, errors, or omissions in the new Convention; but as one is always sceptical, or should be, in war, I go through the different articles and record my reading of them as they stand, just as if I were a burgher, and adhere more to the laid-down ruling than to the spirit. My opinion is, of course, subject to correction. I only beg for information.

Article 1.

"Officers and soldiers, and other persons officially attached to armies, shall be respected and taken care of when wounded or sick by the belligerent in whose power they may be, without distinction of nationality.

Nevertheless, a belligerent who is compelled to abandon sick or

wounded to the enemy shall, as far as military exigencies permit, leave with them a portion of his medical personnel and material to contribute to the care of them."

Who is to decide the military exigencies? The commander of the force compelled to abandon the sick, or the commander taking them over?

Can a force retire and leave sick and wounded without *personnel*, rations, or appliances, with the evident intention of hampering their adversary?

ARTICLE 2.

"Except as regards the treatment to be provided for them in virtue of the preceding Article, the wounded and sick of an army who fall into the hands of the enemy are prisoners of war, and the general provisions of international law concerning prisoners are applicable to them.

Belligerents are, however, free to arrange with one another such exceptions and mitigations with reference to sick and wounded prisoners as they may judge expedient; in particular they will be at liberty to agree:—

To restore to one another the wounded left on the field after a battle.

To repatriate any wounded and sick whom do they not wish to retain as prisoners, after rendering them fit for removal or after recovery.

To hand over to a neutral State, with the latter's consent, the enemy's wounded and sick, to be interned by the neutral State until the end of hostilities."

This is a most important decision for medical units, as it settles the question beyond all manner of doubt. Picking up wounded by day and night in the most hazardous positions, to reduce the bag, can no longer be carried out under the Convention. The new article proves that the Boers were correct in their contention, viz., that all wounded with rifles and bandoliers were their birds, and that if efforts were made to take them away without permission those doing so must take the consequences. For the credit of the Corps, I am sure all ranks in any average engagement will still take the consequences and bring in their wounded comrades. Article 2 is really most humane, as it will make a commander consider the possibilities in the event of a retirement, as wounded left behind must in future be accounted for as prisoners; and an unsuccessful attack followed by retirement, with the loss of some 900 men, cannot be telegraphically described as "a reconnaissance in force, no prisoners, heavy casualties, wounded all doing well" (in the hands of the enemy not stated). It will certainly lighten the work of medical units in rearguard actions, and they will no longer be

See page 634

expected to respond to invitations to go under a cross-fire between their own force and the enemy to pick up wounded, field glasses, or any other articles unavoidedly left behind.

ARTICLE 4.

"As early as possible each belligerent shall send to the authorities of the country or army to which they belong the military identification marks or tokens found on the dead, and a nominal roll of the wounded or sick who have been collected by him. The belligerents shall keep each other mutually informed of any internments and changes, as well as of admissions into hospital and deaths among the wounded and sick in their hands. They shall collect all the articles of personal use, valuables, letters, &c., which are found on the field of battle, or left by the wounded or sick who have died in the medical establishments or units, in order that such objects may be transmitted to the persons interested by the authorities of their own country."

This is a very humane article indeed, and quite necessary in the interests of the next of kin, but it will mean some extra trouble to medical units, more particularly if they have to read all the letters in different languages in the event of a general Continental engagement. In South Africa our army invariably returned such articles as horses, money, rings, watches, skin rugs, and ostrich feathers. Article 4 reads "articles of personal use and letters," so in future we must hand over, in addition to correspondence, the dead warrior's socks, tooth-brush and false teeth.

ARTICLE 8.

"The following facts are not considered to be of a nature to deprive a medical unit or establishment of the protection guaranteed by Article 6:—

(1) That the *personnel* of the unit or of the establishment is armed, and that it uses its arms for its own defence or for that of the sick and wounded under its charge.

(2) That in default of armed orderlies the unit or establishment is guarded by a picquet or by sentinels, furnished with an authority in due form.

(3) That weapons and cartridges taken from the wounded and not yet handed over to the proper department, are found in the unit or establishment."

This is a most rational article and provides for every contingency, especially para 3. Anyone who served in South Africa has often felt the undesirability of strolling over the veldt with a medical unit, at the mercy of any armed kaffir, robber, or mad dog that chanced to come that way.

It is a pity that previous to the publication of this Convention the rank and file of the Corps were disarmed. The Lancaster swords were at no time dangerous weapons, and neither were they of much use, but if rolled up in spongio-piline (black side out) they could be made to look like policemen's batons and then be some protection, as appearances count for a lot in the case of a defending force.

Article 9.

"The personnel engaged exclusively in the collection, transport, and treatment of the wounded and the sick, as well as in the administration of medical units and establishments, and the chaplains attached to armies, shall be respected and protected under all circumstances. If they fall into the hands of the enemy they shall not be treated as prisoners of war.

"These provisions apply to the guard of medical units and establishments under the circumstances indicated in Article 8 (2)."

Article 9 appears quite clear. All the same, as it stands, a cute burgher would take away the quartermaster and the cooks, but of course that is not intended.

Article 13.

"The enemy shall secure to the persons mentioned in Article 9, while in his hands, the same allowances and the same pay as are granted to the persons holding the same rank in his own army."

This article requires immediate consideration by the Accounts Department. From our point of view it is awful, and disastrous to our financial interests. I would advise all brother officers in the event of war with Japan to keep clear of medical units likely to be utilised in this manner, as I understand that the Japs pay a Major-general about 11½d. *per diem*, and other ranks accordingly. The only ones likely to get remuneration for their services would be the chaplains, as religion is not well understood in the land of fans and geishas. On the other hand, should we make use of a Japanese hospital under Article 13, I am sure that the Principal Medical Officer and, in fact, all the staff, would be so delighted at their improved financial condition that they would refuse to leave our employment.

Perhaps Article 13 means extra pay, and if that is really the case, I hold up my hand in its support without hesitation.

ARTICLE 14.

"If mobile medical units fall into the hands of the enemy they shall retain their material, including their teams, irrespectively of the means of transport and the drivers employed.

"Nevertheless, the competent military authority shall be free to use the material for the treatment of the wounded and sick. It shall be restored under the conditions laid down for the medical personnel, and so far as possible at the same time."

This is certainly very clear and in accordance with common sense. I remember on one occasion having to utilise the limber of a gun in action to remove wounded, and under the present article this is permitted.

ARTICLE 15.

"The buildings and material of fixed establishments remain subject to the laws of war, but may not be diverted from their purpose so long as they are necessary for the wounded and the sick.

Nevertheless, the Commanders of troops in the field may dispose of them in case of urgent military necessity, provided they make previous arrangements for the welfare of the wounded and sick who are found there."

I think this article clearly provides for the interests of the sick and wounded, and under it no commander of a force coming into a town would be entitled to remove the helpless of his own side from the most comfortable house, and use it as his own dwelling and office.

N.B.—Medical officers will find the new Convention useful in dealing both with friend and foe.

ARTICLE 17.

"Convoys of evacuation shall be treated like mobile medical units, subject to the following provisions:—

"(1) A belligerent intercepting a convoy may break it up if military exigencies demand, provided he takes care of the sick and wounded who are in it.

"(2) In this case the obligation to send back the medical personnel, provided for in Article 12, shall be extended to the whole of the military personnel detailed for the transport or the protection of the convoy, and furnished with an authority in due form to that effect.

"The obligation to restore the medical material provided for in Article 14 shall apply to railway trains and boats used in internal navigation, which are specially arranged for evacuations, as well as to the material belonging to the medical service for fitting up ordinary vehicles, trains, and boats.

"Military vehicles, other than those of the medical service, may be captured with their teams.

"The civilian personnel and the various means of transport obtained by requisition, including railway material and boats used for convoys, shall be subject to the general rules of international law."

This article was badly needed. It will no longer be possible for a commander in the field, requiring rations from a post which had reported its deficiency of transport, to send to it sixty-eight ox waggons with a delicate man on each, and imagine that the enemy should let them pass through their positions unmolested.

ARTICLE 20.

"The personnel protected in pursuance of Articles 9 (paragraph 1), 10 and 11 shall wear, fixed to the left arm, an armlet (brassard) with a red cross on a white ground, delivered and stamped by the competent military authority and accompanied by a certificate of identity in the case of persons who are attached to the medical service of armies, but who have not a military uniform."

This was absolutely necessary, and the certificate of identification is of infinitely more use than the brassard. I do not like making impractical suggestions, but it might almost include a photograph of the legitimate owner or his thumb mark. No longer will generals of an opposing force be allowed to drive round the position of their adversary, armed with a few wounded on a waggon anda home-made brassard. I would almost suggest that the brassard itself should be made of metal instead of calico, although this might prevent female relations from rendering service to the cause.

I once saw a kaffir ordered to be shot (I am sorry he was not) for being found in possession of a Mauser rifle and bandolier, and a coat with a brassard on the left arm: the coat was turned inside out. As the hearty kaffir explained that the lining turned out suited his complexion better than the material, he was let off.

ARTICLE 21.

"The distinctive flag of the Convention shall only be hoisted over those medical units and establishments which are entitled to be respected under the Convention, and with the consent of the military authorities. It must be accompanied by the national flag of the belligerent to whom the unit or establishment belongs.

"Nevertheless, medical units which have fallen into the hands of the enemy, so long as they are in that situation, shall not fly any other flag than that of the Red Cross."

I quite see the desirability of the flag over buildings and

detached medical units, but, on the other hand, it is a little out of place on an ambulance waggon following immediately in rear of a mounted unit, wherein the grey horses have been dyed khaki with permanganate of potash to render them less conspicuous in warfare.

The new Convention as it stands is, when clearly understood, practical in the extreme, and a humane provision for all wounded in the field and their necessary attendants. There is not one word of false protection in it, and the old idea that, if a medical unit with a Red Cross flag wandered into the middle of a furious battle, hostilities should cease on the attacking side, is absolutely exploded for good and all. No longer, therefore, in war, can an army be accused of unheard of inhumanity because they fired on two squadrons of retiring cavalry, who previously located an ambulance waggon in its orthodox position *Behind the Forces*.

To illustrate "Case of Compound Fracture of the Olecranon."
By Captain W. L. Bennett, R.A.M.C.

Clinical and other Notes.

CASE OF COMPOUND FRACTURE OF THE OLECRANON.

By Captain W. L. BENNETT.
Royal Army Medical Corps.

Private H., of the Highland Light Infantry, was riding a bicycle in the neighbourhood of Fort George on the evening of November 7th, 1907, when he was thrown, striking his elbow against a wall. He was admitted to the hospital at Fort George that evening, where it was found that he had a wound at the back of the left elbow, leading to a fracture. The wound was dressed and the next morning he was sent to the Military Hospital, Edinburgh, for operation, where, a compound fracture of the left olecranon having been diagnosed, he was operated on the same evening.

The wound was enlarged and the fragments wired. There was considerable difficulty about the case, as, owing to the obliquity of the fracture at the upper end of the ulna, it was almost impossible to drill so as to obtain a good hold of the wire; this will be appreciated from a glance at the accompanying skiagraph. The difficulty was overcome by drilling parallel to the line of fracture, and then gouging down to the point of the drill and seizing the end of the wire with forceps.

The wound healed by first intention, passive movements were commenced on the tenth day, and the man was discharged to duty on January 2, 1908, with perfect movement in the joint.

In conclusion, I have to thank Lieutenant-Colonel W. Dick, R.A.M.C., for kindly advice and assistance in the operation.

SCHAFER'S PRONE PRESSURE METHOD OF ARTIFICIAL RESPIRATION.

By Captain G. J. STONEY ARCHER.
Royal Army Medical Corps.

Now that the camping season is coming round again, a number of our officers will be called upon to give instructions to regiments that are going to the sea-side in the methods of performing artificial respiration for the treatment of the apparently drowned. Last year Schäfer's prone pressure method was taught at Belfast, and, as it was found that the men were quickly and easily taught to carry it out efficiently, I thought that the following chart of instruction, which was used and distributed among the different companies, might be a help to any officer who has not yet tried this excellent method.

The advantages claimed for it are: (1) The ease with which the

physical operations necessary to carry on artificial respiration may be performed—hardly any muscular exertion is required; (2) the efficiency of the gaseous exchange produced by it between the outside air and the air in the lungs; (3) the extreme simplicity of the procedure; (4) the impossibility of the air passages being blocked by the falling back of the tongue into the pharynx; (5) the readiness with which water and mucus are expelled from the air passages through the mouth and nostrils; (6) there is no risk of injury to the congested liver or any other organ.

THE PRONE PRESSURE METHOD OF ARTIFICIAL RESPIRATION FOR A PERSON APPARENTLY DROWNED.

(1) Loosen all clothing about the neck. (2) Look into the mouth and remove any weeds, &c., that may be there. (3) Fold a coat, and place it beside the patient, on a level with the hooks for the belt. (4) Roll patient over on his face on to the coat. (5) Place one of the patient's arms under his forehead, and see that the mouth is not against the ground. (6) Straddle across patient, placing your knees on either side of his hips. (7) Place the open hands on either side of the lower ribs (again the belt hooks are a good guide). (8) Leaning forward, exert firm, but not violent pressure on the patient's ribs, then raise your body slowly, at the same time relaxing the pressure with your hands. Repeat this forward and backward movement about every five seconds, or twelve times in a minute. This course must be pursued for at least an hour, or until the natural respirations are resumed.

REMEMBER:—That *not a moment should be lost* in performing artificial respiration, after the patient has been removed from the water. Do *not* give restoratives by the mouth until natural breathing has commenced. Do *not* raise the patient's head off the ground, except as in (5). Persons who have been some time under water often look as if they were dead when such is not the case, and they may be restored to life by carefully carrying out the above instructions.

ARE FLIES THE CAUSE OF ENTERIC FEVER?

By CAPTAIN W. H. ODLUM.
Indian Medical Service, Late Royal Army Medical Corps.

To Lieutenant-Colonel Caton Jones, R.A.M.C., is due the credit of having been the first to wage war on flies, and that with success. In 1903, the Seaforth Highlanders, stationed at Nasirabad, suffered from a very bad epidemic of enteric fever, and, when all other means had failed, it was decided to try to exterminate the flies. This at first appeared to be a hopeless task, as we were not then conversant with the habits and method of breeding of these insects. Finally, the flies disappeared and enteric ceased. We had not a case of enteric fever in Nasirabad from July, 1905, to August, 1906, on which latter date flies reappeared. Although we searched diligently for their breeding ground, it could not be found, and as a result we daily expected an outbreak of enteric. In this we were not disappointed, as we got ten cases, each from a separate barrack room. If these had been caused by infected water, milk, or food, surely we should have had several cases in the same barrack room.

When the breeding ground was discovered and destroyed, flies disappeared in a fortnight, and enteric ceased. Captain A. L. Otway, R.A.M.C., informs me that since August, 1906, not a single case of enteric has been contracted in the station, and that there are no flies.

I do not think dust ever causes enteric, as I found that when *Bacillus typhosus*, lightly covered with dust, was exposed to the sun's rays, it was destroyed in twelve hours. The children in the married quarters are, as a rule, given their food in plates on the floor, and the greater part of it finds its way to the ground, where it gets covered with dust; yet I have not seen a case of enteric amongst these children since the flies were exterminated.

Enteric infection by water may occur, but if it does, I consider that the contamination must be direct and from a recent case. I find that in ordinary water *B. typhosus* disappears in ten days, and in sterile water in about thirty days. It is very difficult to keep the bacilli in broth for more than thirty days during the hot weather in the plains.

Flies caught in latrines are apparently free from any pathogenic micro-organism on their legs or body. How is the infection carried? If one starts with a parrot and goes down the scale to the smallest bird, one finds that the smaller the bird the more frequently it defæcates, and the windows of dirty houses where flies are numerous, are covered all over with small black spots, *i.e.*, fly-excrement. Therefore, I consider that the fly somewhat resembles a minute gun, as he has a very large intestine.

It is a curious fact that I isolated *B. typhosus* from the first fly whose intestine I examined, and that I examined some hundreds before I found a second infected fly. The intestine of every fly is loaded with *B. coli*, many of which are of different types. The fly, I am convinced, defæcates on food, and I think this will account for many epidemics of enteric. Autumn is the most prevalent time at home for enteric, and this is just the season when flies are most numerous.

In South Africa, Colonel Allen May, Principal Medical Officer 8th Division, when in Harrismith, was very keen on the removal of rubbish, &c. During 1901 there were no flies, and not a case of enteric occurred in Harrismith, except in the hospitals, where flies were very numerous, owing to the horses of the nurses and medical officers being kept in the lines. There were also numerous transport animals, the litter and refuse of which was collected in a donga near by, an ideal breeding ground for flies. Flies breed all the year round in India; they will breed in filth of any kind, provided it is not too moist or too dry. The trenching-ground is their favourite place.

The Thornhill system of trenching, which I see condemned in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS,[1] is, I consider, an ideal

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[1] The system has also had many advocates in the Journal.—ED.

system, but worse than useless if improperly done. It requires, in short, constant supervision. Flies lay their eggs in the latrine pans, which are then carried out and planted in the trenching ground; the result is millions of flies, unless the ground is adequately trenched. If carbolic or perchloride be placed in the latrine pans, no flies are produced. Either the fly refuses to lay its eggs or the disinfectant destroys them. The eggs of the fly hatch out in ten days, and the life of a fly is about three weeks. Flies are very difficult to keep alive in confinement. A heap of manure will supply thousands of flies, which disappear in fourteen days when their breeding ground is destroyed.

RECORD OF A CASE OF SLEEPING SICKNESS IN A EUROPEAN.

COMPILED FROM THE MEDICAL CASE SHEETS.[1]

BY LIEUTENANT A. IRVINE FORTESCUE.
Royal Army Medical Corps.

F. T., an Englishman, aged 26, was admitted to the hospital at Entebbe, Uganda, on March 16th, 1906. He complained of severe pain in the head and back, sleeplessness and general malaise. *Trypanosoma gambiense* was found in his blood.

The previous history of the case was as follows: The patient, on March 2nd, had performed an autopsy on a rat whose blood swarmed with *T. gambiense.* He remained perfectly well till March 11th, when he felt out of sorts, had a bad headache, and, on taking his temperature, found that he was slightly fevered (99° F.). The next day, March 12th, he was worse, with much headache and no appetite. He stayed in bed, but was very restless. An examination of his blood revealed the presence of *T. gambiense* in small numbers. Throughout the 13th, 14th and 15th of March, F. T. remained in about the same condition. He got little or no sleep in spite of doses of trional and the application of belladonna plaster to his back. On the 16th he was removed to hospital.

On admission, the only objective signs were a temperature of 102° F., and the presence of trypanosomes in his blood. There was no rash, no œdema, and no glandular enlargement. The subjective symptoms were great pain in the head and back, anorexia and general weakness. By way of treatment five minims of liquor arsenicalis were given by the mouth every four hours.

On March 17th there was an apparent improvement, the temperature having fallen to normal, the backache and headache having disappeared,

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[1] I am indebted to Surgeon-Lieutenant-Colonel C. E. Harrison, Grenadier Guards, for the detailed history of this case.—A. I. F.

and the appetite improved. On the 24th patient again began to complain of distaste for food, and on the 27th he vomited twice after eating a poached egg. As the digestive disturbance was thought to be due to the arsenic, the drug was stopped till the 30th, by which time appetite had returned.

On March 31st patient was moved to Mombasa. He stood the journey well, but found the heat trying. On April 9th patient began to complain of tingling and numbness in the toes and the soles of the feet. The arsenic was again stopped.

F. T. sailed from Mombasa on April 12th, arriving at Venice on the 27th. During the latter part of the voyage he felt better, and was able to sit on deck. A circular patch of erythema about the size of a florin now appeared on the left forearm. The left axillary and the cervical glands were slightly enlarged.

On April 30, when F. T. arrived at Trieste, a profuse painless erythema had appeared all over both the front and the back of the abdomen and chest. There were also a few scattered patches on the legs, with a small spot on the right temple. This rash consisted of bright red more or less circular patches, some as much as three inches in diameter. They were somewhat raised above the surface of the skin, and quite painless, with rather indefinite margins. Some twenty-four hours after the appearance of a patch, it began to fade and take on a greenish tint at its centre. After three days all that remained was a faint ring-like discolouration of the skin. The erythema was followed by a fine desquamation.

On May 3rd F. T. was admitted to the Queen Alexandra Military Hospital, Millbank. On admission he presented a well-marked rash, complained much of headache, and had a temperature of 102° F. Three minims of liquor arsenicalis were prescribed thrice a day by the mouth. He had had no arsenic since April 14th.

On May 9th, the patient's condition being practically unchanged, he received ½ a grain of atoxyl hypodermically. The administration of atoxyl in gradually increasing doses, up to 4 grains *per diem*, was continued till May 28th.

On May 16th a blood count was made, when no trypanosomes could be found. Hæmoglobin was 60 per cent., and the red blood corpuscles numbered only 3,760,000, leucocytes 7,000, per cubic millemetre.

On May 28th patient complained of pains in his toes and the soles of his feet. His toe-nails and plantar epidermis were desquamating; liquor arsenicalis ♏ viii. t.d.s. was substituded for the atoxyl. The calves showed no tenderness on pressure.

On June 7th patient complained of great weakness; he seemed distrait, and appeared to wander at times; his temperature was 100·5° F. On the 8th at 8.50 a.m., immediately after breakfast and while still sitting up in bed, he had an epileptiform convulsion. During the fit the head and eyes were deviated to the right, the pupils were contracted and

insensible to light, the hands were clenched and the thumbs turned inwards, there was profuse perspiration and foaming at the mouth, the respiration was slow and sighing, and the pulse 136. The fit lasted from two to three minutes, and passed off into unconsciousness. A second similar fit occurred at 9.5 a.m., a third at 9.20 a.m., and a fourth at 10.10 a.m. In the third convulsion there was much cyanosis of the face, and jerking of the tongue and of the feet. During the fits the pulse-rate rose to 136. Between the third and fourth fits, at 9.40 a.m., twenty minims of brandy were given hypodermically. At 5 p.m. patient recovered consciousness.

On June 9th patient was very drowsy, but roused himself when spoken to. A few trypanosomes were found in the blood. On the 11th the temperature was normal, but there was a troublesome cough. Patient recognised people and could converse normally. There were no signs of paralysis.

On the 14th the patient twice passed urine involuntarily. His face had lost its natural expression, and he was very weak and drowsy.

On the 17th patient had great difficulty in swallowing. He could not speak, but could reply to interrogations by a movement of the hand. Râles could be heard at the bases of both lungs. The mouth was kept open, and there was a constant dribbling of saliva.

On the 18th patient was much worse. His pulse was 110, and his respirations 30 per minute and Cheyne-Stokes in character. He was quite unconscious all day. Oxygen inhalations and nasal feeds of milk, eggs and brandy were administered.

On the 19th patient was obviously moribund. His pulse was 172 and his respirations 58. He remained quite unconscious. Nasal feeding was continued.

F. T. died at 1.30 p.m. on June 20th. The respirations had gradually become more frequent and shallow, and the pulse faster and weaker. Just before death the temperature was 103° F.

No *post-mortem* examination was performed. After death the body showed extreme emaciation. The pupils were equal and dilated. The face was cyanosed. Enlarged lymphatic glands could be made out in both axillæ and in the left cervical region, all traces of a rash had disappeared, and there were no bedsores.

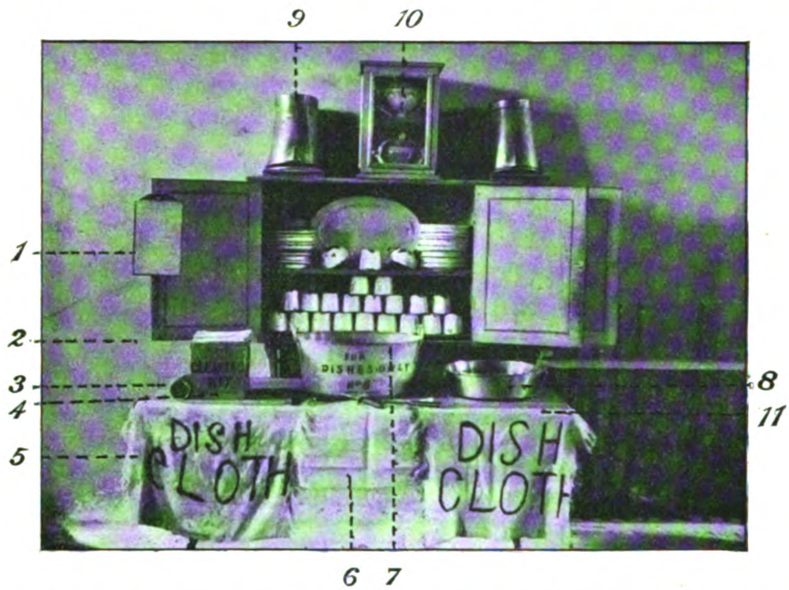
WASHING-UP ARRANGEMENTS IN BARRACK-ROOMS.

By Major W. D. ERSKINE.
Royal Army Medical Corps.

In his "Special Report on Enteric Fever and its Prophylaxis at Umballa, 1905," Lieutenant-Colonel T. P. Woodhouse, R.A.M.C., alludes to better arrangements for the washing-up of food utensils. I venture to bring forward a copy of the Board of Orders provided for the men of the

sanitary cadres of the units of the army of occupation stationed at Abbassia Barracks, near Cairo, relating to the washing-up of dishes. The troops comprise: 6th Inniskilling Dragoons, "U" Battery R.H.A., 3rd Coldstream Guards, Mounted Infantry, and the small units.

The permanent sanitary orderly of each company, squadron, section, &c., is given such a board, signed by the adjutant. They are regimental orders, and learned up and carried out accordingly. These men are never



1, Board of Orders; 2, soldier's sheet new from quartermaster's store, and cut into required lengths; 3, empty "sanitary powder" tin, refilled with bath-brick powder, fresh scraped from the brick; 4, biscuit box, obtained from grocery bar, stripped of its paper covering and polished—holds all the dry cleaning articles; 5, soldier's towel from quartermaster's store, stencilled "Dishcloth" in large letters with marking ink, and used for drying dishes; 6, sponge cloth used for cleaning guns, obtained from quartermaster's store; 7, dish bath (all baths for washing floors, mops, and suchlike, are arranged at the other end of the room); 8, ration tin; 9, tea cans; 10, butter-dishes in box with wire gauze door; 11, six-foot trestle table.

taken away from their sanitary work to any other duties, except absolutely necessary military ones such as a course of musketry, which they must attend to keep efficient as soldiers. On these occasions their places are filled by men approved of by the medical officer, and instructed by him. The Order Board reads as follows:—

Instructions for the Sanitary Orderly Superintending the Washing-up of Dishes after Meals.

(1) All cans, meat dishes, plates, mugs, knives and forks, bath tins, and other utensils used at mealtimes, should be scoured or cleaned on

the *scullery table* of the company on the verandah or in the barrack-room, and *not* placed on the floor or taken to outside taps.

(2) One bath, marked "Dishes," and one ration-tin should be used in the washing-up of such utensils. They should be filled with boiled water from the cookhouse. After a meal the utensils should be first washed in the bath and then passed through the water of the ration tin containing half a teaspoonful of permanganate of potash dissolved in it.

(3) Washing baths for dishes should on no account be used for other purposes.

(4) Clean *sponge cloths* only, should be employed for washing utensils in the bath, and they should be well washed in clean water before drying. These sponge cloths, with the *drying cloths*, should be hung to dry on the scullery table.

(5) Only *clean bath brick*, shaken in from a tin (coffee tin with perforated lid or suchlike), should be used for scouring tea cans, meat dishes, and knives and forks.

(6) The sanitary orderly of the company, under the N.C.O. of the room, should superintend the washing-up after every meal and be responsible to him.

The reason of having a scullery table is, that everything used by the men at their meals and for carrying their food to them, should be cleaned by cleanly means on a table and away from the floor or the ground.

The scullery table should have a sink with hot and cold water near it. Any lack of the needful, including boiled water from the cookhouse, is to be at once reported by the orderly; this seldom occurs.

Anyone who has watched the usual washing-up after meals in barracks abroad, may have seen old shirts used as dishcloths, lying in the tap-water in the bath used for washing floors, or good work done with some bath brick scraped near a night urinal stand, or with sand collected outside the barrack-room verandah by the ever-changing orderly-man or "swab" of the day.

These scullery tables should be inspected daily.

THE ADVANTAGES OF CAREFULLY PROTECTING THE SKIN ADJOINING OPERATION WOUNDS BY THE USE OF GUARDS.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

I was much interested in Major Gunter's paper, which was published in the January, 1908, number of the Journal, but as I am not able to follow him in some of his conclusions, I trust that he will pardon a little friendly criticism.

It is well that one should realise the absolute impossibility of sterilis-

ing the skin throughout all its layer. Major Gunter, by his experiments with the skin of the amputated finger and leg, and by his quotation from Haegler, shows that he does this, and that he realises the necessity for guarding the exposed skin round the operation wound, so as to prevent the transference of germs (which have sweated up from the depth of the skin on to the surface) to the wound. It is a little difficult, therefore, to follow the conclusions drawn from his experiments.

In the last four, contamination of the upper surface of the guard occurred in all, but the germs which one expected to hear were found on the skin surface of the guard were not present. In the case of operation for inguinal hernia, I think one ought certainly to have expected germs on the lower surface, but in the operation for removal of cartilage and fatty tumour of the thigh the explanation of their absence may possibly be due to the efficient sterilising of the surface of the skin, and the rapid completion of the operation before they had time to sweat to the surface. Believing the impossibility of ever rendering the whole thickness of the skin sterile, and knowing how profusely the patient's skin will sweat in an operating theatre which is kept at a temperature of from 65° F. to 70° F., one can hardly agree with Major Gunter's third conclusion, viz., "that if the skin is in an absolutely sterile condition the use of a guard is unnecessary." Many surgeons never use any protection other than the ordinary sterilised towels to surround the operation wounds, but I do not think their results are equal to those who use guards as well. I take it that the ordinary type of germ which finds its way into an operation wound from the surrounding skin, which has previously been thoroughly prepared, is not very virulent, and that if the patient's powers of resistance are good they can be disposed of in the tissues without suppuration resulting. In no other way can one account for the healing by primary union in the case of several large operations which one saw in the open air in South Africa, under the most unfavourable conditions. At the same time, it is, I think, one's duty to take every precaution one can to prevent accidental infection of operation wounds.

I should like to mention some experiments which were made by Mr. Moynihan, of Leeds, about two years ago, with reference to this subject. Cultures were taken from operation wounds, when the surrounding skin was unprotected, within half an hour of their infliction, and also from gloves and instruments. It was found that the wounds were almost always infected within twenty minutes, and usually with *Staphylococcus albus*, although the gloves, instruments, and towel cultures gave a negative result.

On careful protection of the surrounding skin with varnish or "Tetra" handkerchiefs, the wound remained sterile. These results were similar to those obtained by Döderlein on the Continent, and the conclusion come to was that, although the surface of the patient's skin may be sterile at the commencement of the operation, it becomes infected *from beneath*

in the course of the operation, and hence the need for protecting the wound from the surrounding skin. Döderlein uses a sterile rubber-varnish, which he paints over the skin, and through which he makes his incision. "Tetra" handkerchiefs are made of several layers of a very absorbent material, united together at their borders by a single tissue or edge, which is quite fast. They are in several sizes, the most useful being probably 20 cm. by 20 cm., which cost 5s. per 100. They can be washed, re-sterilised, and used at least twenty times, as a rule, dry. I think their use is preferable to a split linen guard, for they can be clipped accurately to the edges of the incision, and are more absorbent. Ordinary sterilised towels are secured round the operation area in the usual manner, and, immediately the incision is made, one handkerchief is clipped to each skin edge. The upper and lower extremities of the incision are clipped together over the handkerchief. In this way no skin is visible during the operation. Properly made clips are used by Moynihan, but failing these, ordinary peritoneal forceps act very well, and they do not damage the skin edges. The handkerchiefs are changed several times during the operation, and they can be clipped to the skin about $\frac{1}{8}$ inch from the edge of the incision just before suturing. As, presumably, the surface of the skin is sterile at the moment of making the first incision, there does not appear to be any objection to steadying it with the finger whilst making the first cut.

The use of a sterile normal saline solution to wash out the wound before closing may, I think, act advantageously by washing out some germs which may have got into it, in spite of the most careful technique. I have, as yet, had very little experience of the use of "Tetra" guards, so am unable to state whether I get better results than formerly. I may add that I never use gloves except in septic cases, and then for my own protection.

NOTES ON THE NEW FIELD LATRINE.

By Lieutenant R. G. H. TATE.
Royal Army Medical Corps.

The disposal of human excreta has always been a problem of importance, especially in crowded areas such as camps, and any advance towards its successful solution should be hailed with interest by all who have to deal with the hygiene and sanitation of large bodies of individuals, such as troops in the field.

During the English manœuvres of 1906, experiments were made with a new system of latrine construction, and it is the object of the present article to note down some of the conclusions arrived at on this subject by the medical officer of a battalion engaged in the Irish manœuvres of 1907, when these latrines were very largely used. The author does not wish

to dogmatise on the matter, but simply to relate his own experience with reference to the subject in hand.

For the sake of those who have not seen the latrine constructed, it may be shortly described as a series of trenches 3 feet long, 1 foot deep, and 1 foot wide, each trench being 2 feet 6 inches from its neighbour on either side. Each trench accommodates one person at a time, who sits astride of the trench over its centre. This position of the user admits of any urine, not voided into the soak pit of the latrine, being caught by the trench, and prevents fouling of the ground surface from this cause. The trenches are best constructed parallel to one another, but this is often prevented by the nature of the ground, as a result of which the most unpleasant experiences may await the unwary who enter the latrine at night, unless the trenches are well marked by lime. For a halt of one night, ten to fifteen trenches for 300 men were found ample.

It is natural to ask, "In what points is the new latrine superior to the old pattern, and is it in any respects less efficient?" To take its advantages first:—

(1) It is much more easily and rapidly constructed, and, as a rule, no pickaxes are needed for the work, as the superficial layers of earth are light and friable. This point is important, as accommodation is so much more quickly provided for men arriving in camp, and much fouling of the ground can thereby be prevented. (2) Much soiling of the ground from urine is avoided, as before mentioned. (3) The destruction of excreta is very thorough. During manœuvres a latrine closed up forty-eight hours before, was opened up completely for the purpose of testing its efficiency. Not a trace of smell was noticeable from the sites of the trenches, and it was difficult to distinguish the matter removed from them from the surrounding earth. (4) The latrines are much more comfortable to use than the old pattern.

As to the points in which the new system may be less efficient than the old, we may mention three: (1) If a camp is to exist for more than two or three days, the area of ground needed for the new latrines is too large, since a fresh series of trenches has to be dug daily. (2) If the wind is high, the paper, &c., is very easily scooped out of the trenches, unless so much earth is used as to fill them up in an absurdly short space of time. (3) In hot sun and high wind the amount of earth removed from the trenches must, when closing the latrine, be augmented by more soil being added to it, as it does not in itself seem sufficient to seal down the contents.

Taking these facts side by side, the new system of latrine construction seems well worthy of further trial, as any improvement, however small, in the sanitation of our camps, may have far-reaching effects in increasing the efficiency of our troops in time of war. Speaking from the experience of two seasons of manœuvres, it would appear absolutely necessary to have a man either constantly on duty at the latrines, or periodically

visiting them, as the troops themselves are, as a rule, careless in sanitary matters, and will not make proper use of the earth set aside for latrine purposes.

THE ENTOMOLOGICAL COLLECTION AT THE ROYAL ARMY MEDICAL COLLEGE.

By Lieutenant-Colonel N. Manders.
Royal Army Medical Corps.

I have received through Lieutenant-Colonel W. B. Leishman two consignments of insects, one from Captain F. H. Hardy, R.A.M.C., and the other from Captain F. Harvey, R.A.M.C.; they have been identified and placed in the collection.

Tabanus variatus ..	Florence Bay, Lake Nyasa; Chinji, Mrongo, N.E. Rhodesia; Henga Valley, Nyasaland; Mafingi Hills, N.E. Rhodesia	Numerous	Capt. Hardy
,, *ustus*	Florence Bay, Lake Nyasa	1	,, ,,
,, *thoracinus* ..	,, ,, ,, ,,	Numerous	,, ,,
,, *laverani* ..	Loangwa, N.E. Rhodesia ..	,,	,, ,,
,, *sp. nov.?* ..	Anfiri River, B.C. Africa ..	1	,, ,,
Hæmatopota, sp. nov.? ..	Mafingi Hills, N.E. Rhodesia	1	
,, *sp. nov.?* ..	Tanganika Road, Nyasa ..	1	

Numerous non-phlebotomic diptera, which have been presented to the British Museum (Natural History).

Tabanus fasciatus ..	Sierra Leone..	2	Capt. F. Harvey
,, *kingsleyi* ..	Fort Lokkoh..	1	,, ,,
,, *variatus*.. ..	,, ,, ...	1	,, ,,
,, *obscurissimus* ..	,, ,, ...	1	,, ,,
,, *socialis*	,, ,, ...	1	,, ,,
Glossina palpalis.. ..	Freetown	Numerous	,, ,,
,, *fusca*	,, ...	1	,, ,,
Cordylobia anthropophaga	,, ...	Numerous	,, ,,
Anopheles costalis ..	,, ...	,,	,, ,,
Culex fatigans	,, ...	1	,, ,,
Stegomyia africana ..	,, ...	2	,, ,,
Culex, sp.?	,, ...	2	,, ,,
Hæmatopota, sp. nov.? ..	Fort Lokkoh	1	,, ,,

Numerous non-phlebotomic diptera presented to the British Museum (Natural History).

I have omitted to acknowledge a large number of diptera from Captain Crawford Kennedy, R.A.M.C. They chiefly consisted of *Culex fatigans*, *Stegomyia fasciata*, and *S. apicalis*, from Malta.

REPORT OF THE FIRST GENERAL MEETING OF THE UNITED SERVICES MEDICAL SOCIETY, MALTA BRANCH.

By Major C. E. POLLOCK.
Royal Army Medical Corps.
Hon. Secretary, United Services Medical Society, Malta Branch.

The first General Meeting of this Society was held on March 4th, 1908, at the Headquarter Office, Valletta. Colonel J. G. MacNeece, A.M.S., President of the Branch, and twenty-four members were present. The minutes of the Preliminary General Meeting having been read and confirmed, the rules drawn up by the Committee were unanimously adopted. The question of holding a Society Dinner was left to the Committee. The following papers on typhoid and paratyphoid fevers were then read and discussed.

Major G. S. Crawford, R.A.M.C., read a paper on all the cases of typhoid and paratyphoid which had occurred in the garrison during the past year, with special reference to the channel of infection. There had been twelve cases of paratyphoid and three of enteric. He showed that in these cases the commonly suspected sources of infection, viz., water, flies, dry-earth latrines, and direct contagion from man to man, were absent. On the other hand, in some of the cases there was direct evidence, and in the others a strong suspicion, of the disease having been contracted by eating uncooked vegetables, such as salads and watercress. In the cultivation of these vegetables in Malta it is customary to empty the contents of cesspits on to the growing plants, which are, therefore, more than likely to contain bacilli of the coli group.

Dr. Mattei (Medical Officer of Health, Malta) pointed out that the water supply of the farms and houses in the country was mainly derived from rain-water collected on the roof and run into underground tanks; in most houses it is usual to keep fowls and other domestic animals on the flat roof of the house, their excreta being thus washed down into the drinking water tank, in which water not only vegetables but also fruits are washed, prior to being brought to market for sale.

Professor Zammit described the catchment area for the municipal water supply, which is highly manured and cultivated; yet, owing presumably to the rough filtration which the water undergoes on its way through the porous rock to the springs from which it is led into the storage tanks, coliform bacilli are almost entirely absent from the water distributed for consumption in Valletta.

Staff-Surgeon Whiteside, R.N., read a paper on the clinical aspect of enteric fever, and brought forward the following points for special consideration :—

(1) The favourable influence of high altitudes and bracing climates on the course of the disease compared with low-lying and enclosed situations. He instanced the epidemic in St. Helena in 1902, where the disease was imported from South Africa. He found the mortality in

Deadwood Camp, where the conveniences for nursing and the numbers of trained nurses were quite inadequate, was only 3 per cent., while the cases occurring in the town were more severe and their mortality much higher, although they enjoyed more comforts and better nursing. Deadwood Camp was 3,000 feet higher and the climate more bracing than in the town, which was enclosed by hills, the temperature being ten degrees higher than in the camp. (2) As regards the complication of hæmorrhage, he considered a pulse of continued high tension a danger-signal. The best treatment, he thought, was discontinuance of all food by the mouth, hypodermic injections of morphine and ergotin, and enemata of starch and opium. With regard to the last remedy, he had failed to observe disadvantages from the fermentation of the starch. (3) All cases of perforation should be treated by immediate operation, as offering the only chance of recovery. He called attention to the importance of a leucocyte count to clinch the diagnosis in the latter complication, as a sudden rise always occurred. (4) He advised that massage to the legs should be employed during convalescence for ten days before allowing patients out of bed, as a preventive measure against thrombosis.

Major C. B. Lawson, R.A.M.C., asked whether citric acid had been tried as a preventive for thrombosis.

Colonel J. G. MacNeece, A.M.S., objected to massage if any indication of thrombosis were present, and spoke of the benefit he had seen in South Africa from the use of bags of common salt well heated and applied to the limb.

Lieutenant-Colonel J. H. Rhodes, R.A.M.C., mentioned that, clinically, typhoid and paratyphoid were indistinguishable, but that paratyphoid was extremely variable in severity, some cases being so mild that a diagnosis could only be made by means of the serum reaction, whereas in other cases the disease was identical with severe enteric. He also said that, although the number of cases under his personal observation was too small to permit of forming any definite conclusion, the paratyphoid A cases presented a much more marked and definite eruption than the paratyphoid B ones.

Major C. B. Lawson, R.A.M.C., read a paper entitled: "Notes on the Serum Test in Paratyphoid Fever."

He had examined the blood of eleven of the twelve cases of paratyphoid fever mentioned in Major Crawford's paper, the usual technique being employed, the strains A and B having kindly been obtained from the Royal Army Medical College by Colonel MacNeece, Principal Medical Officer, Malta. The lowest dilution used was 1 in 20, for which a time limit of thirty minutes was allowed. The result of the test showed that six of the cases reacted to paratyphoid B only, three to A only, and two to both A and B varieties, and that the B strain was agglutinated more rapidly and in higher serum dilutions than the A. In all cases of suspected enteric or paratyphoid fevers he recommended that blood cul-

tures be made, because it must be remembered that: (1) Some normal sera will agglutinate *Bacillus typhosus*, and also that a normal serum diluted 50 to 150 times may clump certain paratyphoid strains; (2) the sera of typhoid patients may agglutinate the paratyphoid group in as high or higher dilutions than they clump the Eberth-Gaffky bacillus; (3) the Widal test may be negative in both fevers, especially in the early stage, a period of extreme importance from the point of view both of treatment and of sanitation.

Professor Zammit spoke of the difficulty of obtaining reliable strains of paratyphoid. He mentioned that he had written to Paris for these, and in reply received twelve different strains, and was informed that it was necessary to test the whole of these in different dilutions with the serum of the suspected case. He suggested that the strain obtained from Tunis would probably be found more nearly approximate to the prevailing type of fever in Malta. He considered that almost all the so-called simple continued fevers of Malta were really paratyphoid in origin, and that the subject was well worth studying.

Colonel J. G. MacNeece, A.M.S., then summed up the discussion, and asked the opinion of the meeting as to when the next General Meeting should be held. It was decided to leave the date to the Committee.

REPORT OF THE ALDERSHOT MILITARY MEDICAL SOCIETY.

By Captain J. G. CHURTON.
Royal Army Medical Corps.

A meeting was held on February 24th, 1908, Colonel Anderson, R.A.M.C., in the chair.

Psoriasis.—Major F. M. Mangin, R.A.M.C., showed a case of psoriasis following vaccination, which he suggested was the active cause in a patient predisposed through hereditary tendency to the disease. Also a case of hemi-chorea following on fright, in a patient with a rheumatic history, in which marked improvement had taken place after the administration of salicylate of sodium and arsenic.

The After-effects of Inoculation with Serum.— Lieutenant-Colonel S. Powell, R.A.M.C., read notes on cases in which urticarial and erythematous rashes appeared, and in some rheumatic-like pains, following the administration of antidiphtheritic serum. He suggested as a prophylactic, calcium chloride.

Tubercular Disease of the Hip-joint.—Captain J. G. Churton, R.A.M.C., read notes of a case in which Sir H. Howse's two-stage modification of Furneaux Jordan's hip-joint amputation was undertaken with fatal result, the patient dying of shock after the second operation. He also read notes introducing a discussion on the diagnosis and treatment of surgical tuberculosis.

Renal Abscess.—Major S. F. Green, R.A.M.C., read notes on two cases, in both of which the condition was due to the pressure of a calculus. Both were treated by nephrotomy, and removal of the stones.

Malingering.—Lieutenant-Colonel H. N. Thompson, D.S.O., R.A.M.C., spoke of a patient he had in hospital who refused to speak, though during the administration of chloroform, whilst in the excited stage, he was able to make remarks. Lieutenant-Colonel L. E. Anderson and Major Mangin mentioned cases of a somewhat similar nature that had come before their notice.

Fracturing First Rib.—Lieutenant W. J. Thompson, R.A.M.C., showed an X-ray photograph taken from a case in which not only was the first rib fractured, but the sternal end of the clavicle of the same side had been displaced upwards. The cause of the lesion seemed to point to a force acting upon the acromial end of the clavicle from in front, first displacing the sternal end and then passing inwards, acting upon the sternum so as to fracture the rib by indirect violence. This appeared to be borne out by the history of the injury.

Reports.

REVIEW OF THE PROGRESS OF HYGIENE IN 1907.

By Lieutenant-Colonel A. M. DAVIES.
Royal Army Medical Corps.

I.—Air and Ventilation.

Carbon Monoxide Poisoning.—The frequency of the occurrence of cases of illuminating gas poisoning, due to its contained high percentage of carbon monoxide, gives importance to any fresh observations as to the manner and conditions of onset. Maass (*Berlin. Klin. Wochens.*, December, 1906) draws special attention to the psychical change that results, a mental state resembling alcoholic drunkenness being often noticed; this may very probably often account for the person affected failing to make any attempt to escape from the danger, or even to open a window.

Lead Poisoning.—The Chief Inspector of Factories reports an increased number of cases during 1906, namely 632 compared with 592 during the previous year. Amongst women workers there was an increase as compared with 1905, in earthenware and china works, 107 against 84 cases, four being fatal. Miss Vines attributes this increased number to carelessness in carrying out the special rules that have been framed for the workers' protection, accompanied by want of cleanliness.

II.—Water and Water Supply.

Water Purification.—It is now becoming acknowledged that a most effective purification of a water supply takes place merely by storage

under conditions that prevent the recurrence or continuance of pollution. Professor Thorpe has compared the average chemical composition of filtered Thames water delivered to London in 1902 and 1903 with that of the unfiltered water delivered from the Staines reservoirs in February, 1905. These reservoirs were filled with Thames water in 1902-03, and were first drawn upon at the end of December, 1904.

	Filtered water 1902	Filtered water 1903	Unfiltered Reservoir water, February, 1905
Total solids	28·28	30·23	23·28
Chlorine	1·90	1·65	1·80
Total hardness	19·90	21·20	16·00

It is seen that there is a notable diminution of the hardness in the stored, as compared with the filtered supply. It has also been found that the nitrates almost disappear from stored Thames water, and the total combined nitrogen is very much reduced. In 1906 the carbonates, or temporary hardness, were reduced by 50 per cent. on storage.

This purification is equally marked in regard to the bacterial content of the water. "All the available evidence points not only to the practical inability of pathogenic bacteria to multiply in water, but also to the fact that their loss of vitality is only a question of time. If water is stored for weeks and months, the possibility of any harmful bacteria surviving becomes excessively remote."—*Houston.*

The policy of providing storage reservoirs on a large scale has been adopted by the Metropolitan Water Board, primarily, it is presumed, to secure a sufficiency in quantity for the needs of London, but with the added benefit of improvement in quality. In April, 1907, two reservoirs were taken into use at Staines, having a joint capacity of 1,200 million gallons. The total storage capacity now possessed by the Board is 8,884 million gallons, being about forty days' average consumption for the population provided for, viz., 6¾ millions. The daily average supply per head is now 34½ gallons.

Water Purification by Copper Sulphate.—Dr. Howard Jones has reported a successful instance of reservoir purification by this method (*Public Health*, January, 1907). At Newport, Monmouthshire, there has been for some years an objectionable fishy smell in the drinking water during the spring months, due to a growth of *algæ*. In 1905 copper sulphate was added to one of the reservoirs in the proportion of one part per million (10 lbs. per million gallons). The salt was divided into 28 lb. bags, which were towed over the surface of the reservoir, the process taking about four hours. Within half-an-hour a white flocculent coagulum appeared on the surface, which gradually sank; within twenty-four hours there was a marked improvement; in less than a week the water became brilliantly clear, and was turned into the mains free from any objectionable trace of copper sulphate. Two other reservoirs were

afterwards similarly treated, with equally good results. There was no recurrence of the trouble in 1906.

Diarrhœa Outbreak due to Contaminated Water.—It is well that we should be occasionally reminded of the far-reaching potency of a contaminated water supply to spread disease. The Lincoln enteric epidemic of 1904-05 was an instance in point. An extensive outbreak of diarrhœa and vomiting of severe character, but without fever, and transient in duration, occurred at Warren, Pennsylvania, in December, 1906, nearly 3,000 persons, about one-third of the population, being affected. The water supply of the town is derived from wells, 60 feet deep, exposed to contamination from a river that frequently overflows. The water is usually of good quality, but at the time of the outbreak evidence of sewage contamination (including presence of *Bacillus coli*) was found to exist. Only those persons who used the wells were affected. Warning was given to boil the water: those who did so had no further symptoms: those who did not continued to suffer from diarrhœa for a fortnight. No enteric fever developed.—(*Journal American Medical Association*, March, 1907.)

The *Bacteriological Examination of Surface Wells* is the subject of a very valuable paper by Dr. W. G. Savage in the *Journal of Hygiene* (July, 1907). In this are brought together not only the results of laboratory examinations, but also the opinions formed on careful inspection of the local conditions in the case of fifty different surface wells; hence the especial value of this contribution. The wells are considered in three series, according to their condition as determined by inspection :—A, wells free from any risk of contamination; B—wells showing obvious possibilites of pollution, more or less direct; C—wells showing no gross evidence of pollution, but which were considered to be probably liable to it, from their proximity to houses, or from their being surrounded by manured land. All the wells examined, with two exceptions, were brick lined, but were not in any way made impervious. The depth varied greatly.

In Series A (8 wells, 10 samples), with the exception of one well, all samples were free from *B. coli* and streptococci in 50 cc.; larger amounts were not examined. The number of bacteria per cc. developing at 37° C. was always small (once 33, once 24, the rest below 10 per cc).

In Series B (10 wells, 22 samples), with one exception, all the wells showed presence of *B. coli* and streptococci in 50 cc. or less: in 9 out of the 11 wells, excretal *B. coli* was found in 1 cc. The number of organisms developing at 37° C. was over 100 per cc. in 14 out of the 22 samples.

In the two classes of wells above mentioned, the agreement between the opinion arrived at from inspection and that resulting from the bacteriological examination is noteworthy.

The majority of samples belong to Series C, and it is for these that bacteriological assistance is most required. Savage differentiates them

into three groups. Group *a* forms the largest class, consisting of draw wells in country districts and villages, situated in gardens or plots of ground attached to houses, but at some little distance therefrom, the ground being usually cultivated and manured; generally fairly deep, brick-lined, but not imperviously steined; either open, or very slightly protected, but not exposed to direct access of surface water; drawn upon in the usual way by bucket and chain. Excretal *B. coli* was found in 50 cc. in 9 out of 14 wells, in 7 of these being present in 1 cc.: in 8 out of the 14 wells streptococci were found in 50 cc. The number of organisms developing at 37° C. was over 100 per cc. in 11 out of the 14 wells.

Group *b* consists of 9 wells, similar to those in group *a*, except that they are covered over and provided with a pump. In 3 out of the 9 wells excretal *B. coli* was found in 50 cc. or less; in no case was it found in 1 cc.; streptococci were found in 4 wells in 50 cc. or less. Only in one well did the number of organisms growing at 37° C. exceed 100 per cc. Group *c* consists of 9 wells situated in the town of Colchester itself, all well covered and provided with a pump, surrounded by houses, all of which are drained and provided with water closets; the surrounding soil should therefore be free from pollution; the wells are probably not impervious. In 9 such wells excretal *B. coli* was found in 50 cc. or less in 5 instances; in 1 cc. in 2 instances; streptococci were found in 50 cc. or less in 3 instances. The bacterial count at 37° C. was under 100 per cc. in 8 out of the 9 wells.

The following table summarises the results, the figures denoting the number of *samples*, not the number of different *wells*, examined:—

	Series			Total	Percentage Results		
	A	*B*	*C*		Un-polluted	Obviously liable to pollution	Doubt-ful
Number of samples	10	22	54	86			
Excretal *B. coli* in 0·1 cc.	0	4	3	7	0	18	6
,, ,, 1·0 ,,	0	11	14	25	0	50	26
,, ,, 10 ,,	0	12	20	32	0	55	37
,, ,, 40 ,,	1	13	24	38	10	59	44
Absent from 50 ,,	9	9	30	48	90	41	56
Streptococci in 1 ,,	0	6	13	19	0	27	24
,, ,, 10 ,,	0	15	17	32	0	68	31
,, ,, 40 ,,	1	17	26	44	10	77	48
Absent from 50 ,,	9	5	28	42	90	23	52

Use of Fluorescein[1] *for Detection of Sources of Contamination in Water Supplies.*—Messrs. J. McCrae and P. G. Stock describe the use of this method at Johannesburg, in 1906 (*Journal of Hygiene*, April, 1907). The water supply for the town is chiefly derived from deep wells in the dolomite, twenty miles to the south west; but one suburb, Parktown, has a separate supply from two wells in the shales of the

[1] Fluorescein (resorcinol, phthalein anhydride, $C_{20}H_{12}O_5$) forms an orange solution in alcohol, which, when diluted with water, gives a green fluorescence.

Upper Witwatersrand beds. Tests had shown this to be chemically pure, but occasionally to contain *B. coli*, attributed to accidental and temporary contamination. In December, 1905, a sample showed marked increase in the albuminoid ammonia, and was described as "dirty"; from this time until March, 1906, though said to be chemically "above reproach," *B. coli* was found in 10 cc. or less. No. 1 well is 75 feet deep, passing through alluvium into weathered shales, with no proper lining. Enquiry and inspection showed that the water in a neighbouring spruit (watercourse) was lowered after heavy pumping; and it appeared as if pollution was gaining access to No. 1 well from this spruit, and the "vlei" (adjoining marshy ground), on account of a reversal of the natural flow, due to the pumping.

Three trial pits were dug in the "vlei," 6 or 7 feet deep, and fluorescein put in. The well was pumped, and after six hours the water had fallen 45 feet; the water in the trial pits had sunk 14, 11, and 4 inches respectively. Fluorescein could not be found in any of the well samples, but it was detected on concentrating the water from 2,000 cc. down to 10 cc., and connexion between the spruit and the well was thus demonstrated. The well was examined, and a fall of rock found to have taken place recently, which had probably opened up fissures. The well has since been improved, and the supply is now found to be pure.

It was found, when fluorescein was added to water in the proportion of one part in 550,000, and the water passed through a column of soil, that at first the fluorescein was completely removed from the water, but as filtration continued it was restored to the filtrate. The authors conclude that the appearance of fluorescein will not be simultaneous with the percolation of the water, but will be delayed, more or less, according to the fineness of the grain of the material through which it passes. Concentration by evaporation is recommended to make recognition easier; 2½ litres may be brought down to 5 cc. (but not less), the "concentrate" filtered, and the filter washed with distilled water. It is recommended that it be examined in a Nessler tube against a dark background: one part in 50,000,000 is said to be just recognisable. The water should be alkaline. In Dr. Monckton Copeman's report on enteric fever at Fulbourn Asylum, near Cambridge (1906), it is said that "the colour imparted to water by the addition of an alkaline solution of fluorescein was perfectly obvious in a dilution of one in 10,000,000 parts; and still appreciable in the still greater dilution of one in 100,000,000 parts." At Fulbourn, where the formation is chalk, fluorescein was found to pass through the chalk for a distance of about two thirds of a mile in a horizontal direction, the greenish colour being clearly recognised about twenty-four hours after its application to water in a hole in the chalk. The distance between the trial pits and the well in the Johannesburg instance is unfortunately not stated.

(*To be continued.*)

Translation.

THE MEDICAL DEPARTMENT OF THE BRITISH ARMY.

By Stabsarzt JOHANN STEINER.
Imperial and Royal Austro-Hungarian Army.

Translated from the *Wiener Medizinische Presse*, February 5th, 1908.

By Lieutenant A. IRVINE FORTESCUE.
Royal Army Medical Corps.

Two trips made to England in successive years, which gave me the opportunity of seeing much of the British Army Medical Department and of meeting many of my British fellow medical officers, have enabled me to write a short account of my personal impressions of the Medical Service in the British Army. I feel the more inclined to do this because the British Army is one in which the Medical Department occupies a position commensurate with its importance among the special departments of military organisation. This has not, indeed, always been the case, but the incalculable services rendered by the British Army Surgeons both in peace and war, often in spite of totally inadequate equipment, the pertinacity with which the medical officers conducted the campaign in favour of adequate recognition, the support of Parliament, the powerful aid of the medical profession and of the Press, together with the good sense of the supreme military authorities and of the Secretary of State for War, have combined to bring it about that in the British Army of to-day no difference, beyond the special nature of their duties, exists between medical and combatant officers.

The British Medical Officer was accorded full military status in the summer of 1898 by the formation of the Royal Army Medical Corps, since which time he has enjoyed the same military titles, precedence, and marks of rank as any other officer of the Army. It is only the surgeons of the "Guards" who retain compound titles, such as "Surgeon-Captain," and they do not belong to the Royal Army Medical Corps, but to one of the "Guards" regiments.

At the head of the British Army Medical Service stands a Director-General, ranking as a Lieutenant-General. The present occupant of this post is Sir Alfred Keogh, K.C.B., who has reached his lofty position while still a comparatively young man. He controls both the military and the scientific sides of his department.

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The British organisation of field-ambulances first came into existence in the year 1905, when the British, on account of their experiences in South Africa, combined into one the hitherto completely separate units of bearer company and field hospital of a hundred beds. The present field ambulance is divided into a bearer division and a tent division, both of which can be subdivided into three sections.

The reason why bearer company and field hospital were combined into one unit was that, in South Africa, the bearer companies, as soon as the work of collecting the wounded was completed, marched off with their brigades, regardless of the vast amount of work which now fell to the field hospitals, while they themselves had nothing to do. On the other hand, during a battle the field hospitals remained idle in the rear, while the bearer-companies could scarcely overtake the arduous duty of rendering first aid to the wounded. Thus the two forms of medical unit failed to mutually assist one another. It is noteworthy, however, that the present arrangement meets with by no means universal approbation from the British Medical Officers; but then it is always the case that any decisive measure is received, interpreted, and carried out differently by different people.

After the last Manchurian campaign, many opinions were heard in favour of complete separation of the work of transporting the wounded from that of giving medical and surgical aid. This point must not, however, be too strongly insisted upon, since a union of the transport and hospital staffs under a single commander must be of advantage as regards employing the *personnel* to the best advantage; for the chief stress of work will fall sometimes on the transport, sometimes on the hospital, and the less busy section can reinforce the other. At the same time the British organisation allows of separate action of the two sections at any time, when they resemble the Austrian arrangement of an "Ambulance Staff" of a divisional medical establishment, and of a "Transport Column" of a field hospital.

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A peculiarity of the British Army (and indeed of the British Empire) is the existence of a vast number of committees, commissions, boards, councils, &c., thus securing the participation of as many individuals as possible in all official decisions and regulations, and preventing the preponderating influence of a single personality, the Army in Britain being absolutely under the control of the people. Civilians occupy positions on various boards and councils connected with military affairs; thus the Army Council, the supreme authority in Army matters, possesses no less than three civil members, the Secretary of State for War, the Parliamentary Under-Secretary of State, and the Financial Secretary. As regards military medical administration, the Army Medical Advisory Board was formed after the South African war. It consists of the

Director-General of the Army Medical Service, the Deputy Director-General, two senior officers of the Royal Army Medical Corps, five eminent civil practitioners (physicians or surgeons), a representative of the directorate of fortifications and works, a representative of the India Office, and a secretary (an officer of the Royal Army Medical Corps). The civil members of the Advisory Board include at present the King's Serjeant-Surgeon, Sir Frederick Treves, Bart., Hon. Colonel, R.A.M.C. (M.).

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At a great review in honour of the King and Queen of Denmark, held on the magnificent green expanse of Laffan's Plain at Aldershot, I saw a field ambulance on the march. It was divided into its two component parts, and marched with the other divisional troops, Artillery, Engineers, and Army Service Corps, at the head of the brigade. Under the command of a major of the Royal Army Medical Corps on horseback, 114 men and ten four-horse waggons marched past in extended formation and with faultless alignment, while the band played the march of the Royal Army Medical Corps, "Her Bright Smile Haunts Me Still." The mounted officers in command of the various ambulances and sections (captains of the Royal Army Medical Corps), saluted their Majesties without drawing swords.

In addition to the troops on parade, two officers and 110 men of the Royal Army Medical Corps were employed, along with other troops, to line the review ground. It struck an Austrian soldier as curious that a large number of regulation ambulance waggons, fitted with seats, were employed to carry civilian spectators, apparently friends and relations of officers, to and from the review. During the progress of the King and Queen of Denmark through the streets of London men of the Royal Army Medical Corps, in review order and with open stretchers, were distributed among the troops on duty in the streets; and at each of the important crossings along the route there was an officer of the Royal Army Medical Corps with an ambulance waggon and a small detachment of men, ready to render first aid if required.

In the great military station of Aldershot there is a special section of the Royal Army Medical Corps, *i.e.*, the depôt and the school of instruction for the men of the Corps. Here, also, the young officers on probation go through the military part of their training. The Army Medical Department possesses here comfortable barracks, a training school, a parade ground, a games' field (turf, not sand or gravel), a soldiers' institute with reading and recreation rooms, messes for the officers and N.C.O.'s, quartermaster's stores, &c. Close by is the huge Cambridge Hospital with its fine garden. Near the officers' mess, on the summit of the ridge on which stand the buildings of the Army Medical Department and close to the high road, there is a splendid and

striking monument, erected on May 24th, 1905, to the memory of the officers and men of the Royal Army Medical Corps who fell in the South African War. From the middle of a semicircular wall of granite rises an obelisk about eight metres high, supported on four crouching lions, and bearing the crest of the Royal Army Medical Corps, consisting of the rod of Æsculapius within a laurel wreath, surmounted by the royal crown with the motto, "*In Arduis Fidelis.*" Under the crest is the inscription in large letters, "To those who gave their lives for their country." In the centre of the semicircle is a most artistic bronze group, showing a medical officer in the act of attending to a wounded man, who is supported in the arms of a soldier of the Royal Army Medical Corps. Beneath the group is the inscription, "South Africa, 1899-1902." Fastened upon the semicircular granite wall are fourteen bronze tablets recording the names of twenty-one officers and 293 men of the Royal Army Medical Corps who died of wounds or disease during the late Boer War.

This monument, erected through the exertions of the officers and men of the Royal Army Medical Corps, redounds to the honour not only of the heroes whose names it records, but also of its energetic originators. It was unveiled with great ceremony by His Majesty the King of England in person, who, in an eloquent speech, expressed his appreciation and gratitude for the services of the Royal Army Medical Corps in South Africa. Certainly no Army medical officer can gaze on this memorial without being filled with emotion, and at the same time with a just pride in his noble profession.

At Aldershot I saw, among other things, a company of the Royal Army Medical Corps at drill. The men wore khaki uniform. In certain movements they removed their jackets and rolled up their shirt-sleeves. Such exercises seemed to me more athletic than military.

While Aldershot is the depôt, the Royal Army Medical College, London, is the scientific headquarters of the British Army Medical Department. In the year 1860 the first Army Medical School was started at Fort Pitt, Chatham, in pursuance of the scheme of reorganisation of the Army Medical Department devised by the Right Hon. Sidney Herbert, then Secretary of State for War. In 1863 the school was moved to Netley, near Southampton, and united with the Royal Victoria Hospital. The Netley school achieved European fame through the labours and discoveries of Maclean, Longmore, Parkes, Notter, Porter, and others; but the distance from the great centres of scientific work in London was a disadvantage which became more marked as years went by, and eventually the school was transferred to London.

Close to the Tate Gallery, so famous for its art treasures, there now stands on the left bank of the Thames a stately building of considerable architectural merit. This is the new Army Medical School. It consists of two separate blocks, one devoted to study and research, the other con-

taining the officers' living and reception rooms. In the former there is on the ground floor a lecture-room seating 200 people, with laboratories and research-rooms for work in bacteriology and hygiene. The two large laboratories for the use of the classes at the school are particularly noteworthy. They are lighted from above and furnished with every modern appliance. On the first floor there are more research-rooms and the library, while on the second floor are various museums and a photographic room. In the cellars are the steam heating apparatus, a carpenters' workshop, sterilising and disinfecting rooms, and a special room for experiments in gunshot injuries.

In the block fronting the Thames there are, on the ground floor, the kitchens, store-rooms, servants' quarters, a billiard-room, and a waiting-room. On the first floor is a large dining-hall with a musicians' gallery, a smoking-room, and a reading-room. On the second, third, and fourth floors are quarters for seventy-seven officers. In one wing of the building is the house of the Commandant.

Not far from the College is the Queen Alexandra Military Hospital, which serves for the clinical instruction of officers at the College. Built in 1903, it has 220 beds. In one room, instructive cases of tropical diseases are demonstrated. The hospital has a remarkably bright appearance owing to the flowers which decorate its verandah. Its high state of efficiency is largely due to the exertions of its present Commandant, Surgeon-Colonel C. E. Harrison, of the Grenadier Guards. This officer holds the high position of Honorary Surgeon to H.M. the King. It is a remarkable proof of the high estimation in which military medical officers are held in Britain that there are always twelve of these officers appointed either honorary physicians or honorary surgeons to the King, thus forming part of the Court *personnel*. It is curious to note that in Court ceremonial, which is generally at least a century behind the times, the marked distinction between physicians and surgeons is still maintained.

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A specially interesting and important branch of the medical department of the British Army is the Queen Alexandra's Imperial Military Nursing Service. This corps of nurses was founded in the year 1902, as the result of experience gained in the South African War. It is managed by a Nursing Board, of which the President is Her Majesty Queen Alexandra.

The *personnel* of the Queen Alexandra's Imperial Military Nursing Service consists of a matron-in-chief, chosen by the War Office, two principal matrons, thirty matrons, and more than two hundred sisters and staff nurses. They all wear a grey uniform with scarlet facings. The motto of the Nursing Service is "*Sub cruce candida.*"

The employment of women in the British military hospitals has

turned out a success, unpleasantness being avoided by the fact that the nurses are drawn from the upper classes of society, and occupy a social position far above that of the private soldier. This strongly marked difference of grade is enforced by strict discipline.

In conclusion, I have great pleasure in expressing my deep sense of indebtedness to Sir Alfred Keogh, K.C.B., M.D., K.H.P.; to Lieutenant-Colonel W. G. Macpherson, C.M.G., R.A.M.C.; and to Lieutenant-Colonel M. W. Russell, R.A.M.C., for their kindness in explaining to me the composition and working of the Royal Army Medical Corps.

Reviews.

FEVERS IN THE TROPICS. By Major Leonard Rogers, I.M.S. Oxford University Press, 1908, pp. xviii. and 343. Royal quarto. Price 30s. net.

The title of Major Rogers' book is somewhat misleading. It is "an original account of fevers—based on the notes and charts of some two thousand cases in which I have personally examined the blood by modern diagnostic methods." Major Rogers' experience is exclusively Indian, hence the extension which he has given his title is not in fact correlative with his observations.

A record of personal observation and research has always some special value as compared with the results of the consideration of the work of others. The inclusion of accounts of sleeping sickness and yellow fever, which have not come under Major Rogers' personal observation, though useful, is inconsistent with the general intention of the book.

Major Rogers has been led to the conclusion that "a large proportion of fevers in the tropics can be diagnosed within two or three days by purely clinical methods." This is very good news if it be borne out by experience. There is, of course, no question but that in a large number of cases of fever, clinical observation alone will lead to a diagnosis about which no reasonable doubt can exist. If diagnosis were purely a matter of record, or even of treatment, one would be more inclined to accept the results of clinical observation as usually accurate. Again, if one elects to accept the result of clinical observation only when it points to the positive diagnosis of an infective disease, this method appears to be harmless. But it is certainly dangerous to accept clinical observation alone where the diagnosis is negative in relation to an infective disease, and further, if methods of prevention are to be effective, they must be limited to those cases actually requiring the active measures which alone appear to be successful. All these active measures cost money, they

interfere at every point with the ordinary routine of the service, and if they are pushed beyond what can be actually proved to be necessary, the burden will become greater than can be endured. It is certain that all sanitary measures must be limited to those which are *known* to be definitely advantageous: those which *may* be useful only produce unnecessary complications. Unless, then, we are in a position to diagnose the majority if not the whole of the cases with certainty, not only positively, but negatively, by clinical observation during the first few days, we are still driven back to the laboratory methods of greater precision, and even these, of course, still leave some small portion of cases indeterminate.

It is this proposition of Major Rogers which is most important from the side of prevention, the maintenance of the efficiency of an Army either in quarters or in the field. It therefore requires some detailed examination.

The most important disease in the Britist Army abroad is enteric fever. Major Rogers gives a very good account of the clinical variations in the typhoid picture, remarkably good when one considers the small number of cases observed, only 129 in Europeans in Calcutta. There is, of course, small scope for originality here. He bases his clinical diagnosis on the following points: character of the pyrexia, the "typical history," the general appearance (with a caveat here as to confusion with his "seven-day" fever), the pulse rate in relation to the temperature, and the condition of the abdomen. All these points are sufficiently well recognised by those who have had any experience of typhoid, especially out of Europe. It is universally recognised that the "typical" chart is uncommon even here, that a sudden onset is not uncommon, that a high continued fever conforming to his definition as "a temperature keeping persistently above 101° F., and not varying over more than 2° F. for at least forty-eight hours, a four-hourly temperature chart being kept," is practically characteristic only of enteric fever. Rogers finds that in his whole series of cases "a little over 70 per cent. showed this type," a proportion which is greater than one believes to be usually the case.

Major Rogers appears to have had comparatively little experience of the other and less distinctive types of pyrexia; he found a remittent type the commonest after the high continued type, but the "low continued type," and the type with an intermittent curve throughout the disease, both of which are so common in South Africa, appear to have been rare in his experience. But when we arrive at the crux, the diagnosis of the mild and abortive cases, we find then that clinical diagnosis is in his opinion of little value, that these "are exceedingly difficult to diagnose in the tropics without a blood examination." In fact, the most severe criticism of his dictum that a large proportion of fevers in the Tropics can be diagnosed by clinical methods alone is found in his remarks on his case mortality in this series, viz., 16·3 per cent. This he says "is probably still in excess of the true rate, for it has already been mentioned that only cases in which a positive Widal reaction was obtained, or where the clinical symptoms were quite typical of typhoid, have been included in my tables. In addition to these, a number of cases occurred whose blood gave negative reactions, and a few in which it was not tested, but which ran a course parallel with the number of short continued and mild

remittent typhoids with positive Widal reactions, and most of these were ultimately diagnosed as typhoid. I have no doubt that many of these were true typhoid, or the variety of the disease sometimes classed as paratyphoid, although they have been excluded from my tables as a possibility of doubt remained concerning them." That is, clinical observation plus Widal reactions left indeterminate a number of cases which Rogers thinks may have been typhoid, a number which is sufficient to bring his case mortality down from 16·3 per cent., the actual observed rate, to 12·9 per cent. This is an important remainder, and goes far to discount Major Rogers' proposition as regards typhoid at least. Everyone with a few years experience in India or South Africa knows that some cases can be diagnosed almost at a glance, the features are so distinctive, and Major Rogers does not in fact go beyond this, although the reasons why this is the case are most excellently put forward.

Before leaving this subject, enteric fever, there are two points to which attention must be directed. Major Rogers calls attention to the frequency with which cases of enteric in country-born children up to the age of 14 came under his observation, 41·67 per cent. of seventy-two cases among Europeans born and bred in the country, as compared with only 11·02 per cent. under Curschmann at Hamburg, 9·59 per cent. at Leipsic, and 7·73 per cent. under Osler at Montreal. His conclusion that "the incidence of typhoid among Europeans born and bred in the tropics is four times as great among children under 15," as compared with temperate climates, is, however, hardly justifiable. Apart from the impossibility of comparing the distribution of a hospital population as to age with any degree of accuracy in circumstances so totally different, there is this to be remembered, that not only is the age distribution in London markedly skew, but the maximum is at the age of 14, as is well shown in a diagram by Professor Karl Pearson dealing with the cases in the Metropolitan Asylums Board hospitals. Further, taking two years attacks (cases notified) in London for comparison, in both 1896 and 1903 (years which happen to be available), the maximum attack rate was between 15 and 20, and the attack rate between 10 and 15 was only slightly less, 95 per cent. in 1896, and 95·6 per cent. in 1903, as compared with the maximum rate between 15 and 20. Major Rogers' inference is, then, incorrect as regards attacks, and the proportions of admissions to hospital are not comparable.

The second point is in relation to this case mortality, twenty-one deaths in 129 cases, or 16·28 per cent. He considers this in relation to the case mortality in the British Army in India, and infers that the higher case mortality there means the exclusion of the milder cases of enteric and their inclusion in some other category. This transference is, of course, probable on other grounds, and much that he has to say on this point is quite correct, *e.g.*, the inverse relation between recorded prevalence and case-mortality is observed not only in individual stations in India, but generally throughout the globe. But his series is in the first place too short to give any reliable criterion. His percentage, 16·28, is affected by a probable error of 2·21, or taking the usual multiple of this, the true death rate from his series may be between 9·65 per cent. as a minimum and 22·91 as a maximum. Now, in 12,269 cases in the British Army in India between 1896 and 1905 there were 9,196 deaths, or 25·05

per cent., with a possible range between 24·26 per cent. as a minimum and 25·84 per cent. as a maximum. The actual difference is small though distinctive, but not nearly so significant as Major Rogers appears to believe. Another difficulty is the enormous variation in case mortality which is seen in different series. Taking one series for example (Brownlee, *Journal of Hygiene*, vol. v., "Enteric Epidemics in Glasgow"), in April and May 1898-99, 103 cases gave 13 deaths, in the same period next year, 49 cases gave 11 deaths. Take another example. In Maritzburg in 1897, 115 cases gave 6 deaths, in 1898, 114 cases gave 18 deaths. The comparison of case-mortalities under different conditions is full of fallacies; age distribution (which, however, affects this particular case only very slightly), differences in environment and other factors, all affect the results, and make it very difficult to get at the truth. It may be mentioned that the case-mortality in the South African War was 13·91 per cent.

As regards Malta fever, Major Rogers does not appear to have had any personal experience, although he gives a useful summary of the knowledge of this disease, particularly in relation to India.

Major Rogers says that the temperature curves in malarial fever are "for the most part so typical that they commonly enable a confident opinion being formed not only as to the presence of malaria, but also of the variety of the disease," and that a lack of knowledge of these characteristics has been the cause of much of the confusion of it with other fevers, and *vice versa*. But he says, "however, the classical text-book charts are seldom seen in practice" owing to the effect of quinine, and the withholding of this drug is not justifiable in many places under ordinary conditions of work. That is, the temperature chart can only exceptionally be used as a trustworthy guide. This, again, is surely a matter of common knowledge, as is his differentiation of malarial from other fevers by the result of the administration of "adequate doses of quinine," with a few days record of the temperature-curve during this administration. This is the familiar method of trial and error. So that the clinical diagnosis of malarial fever, though possibly often trustworthy, is not immediate. One point Major Rogers very wisely insists on, that is, the use of four-hourly charts in all cases, at least at the outset. In this connection, one would have liked to have seen some account of the normal thermometry of the body, as the present state of knowledge leads one to believe that the normal variations in the temperature of the healthy man are so great that the unwary may at times be led to suspect some disease condition when nothing more than the normal variation exists. One may take, for example, the account of "low fever of European immigrants," of which Major Rogers says that "the essential feature of the affection is a rise of temperature to between 99° and 100°, or occasionally to 101°, especially if the patient goes out in the sun, or takes any unusual exercise. The rise always takes place in the middle of the day or early afternoon (when the atmospheric temperature has reached about the daily maximum) and declines again in the evening, being usually normal in the early morning." Now, except for the rather early period of the rise, which differs from the curve of normal variation apart from exercise in temperate climates, the observations of Haldane, Pembrey, and others show that variations of this degree occur in men in perfect health, especially under the influence of external heat or exercise, particularly if the clothing is not unusually

light. So that as far as the temperature record goes, there is nothing distinctive in this particular case. Generally speaking Major Rogers' charts are consistent, but the importance of the site of observation is not referred to. Probably rectal temperatures cannot be used habitually in practice, but the usual mouth temperature is not trustworthy, and an axillary temperature in the tropics, where the cavity is usually damp, is an imperfect index of the internal temperature. Hence one is less disposed to place as much reliance on the ordinary temperature chart as indicative of finer details as Major Rogers appears to do, though this is a matter very greatly affected by the practise of the observer.

The section on "unclassified long fevers" is interesting. Apart from the low fever referred to above, Major Rogers thinks that "although the doubtful irregular long fevers under consideration may possibly belong to some one or more still undifferentiated tropical diseases, yet they present no features incompatible with their being either paratyphoids, including the class recently described by Castellani, or early cases of sporadic kala azar, but they require further study," &c.

In the section on "unclassified short fevers," Major Rogers points out that the erroneous idea that all short fevers were malarial is now being replaced by the recognition of definite forms of disease, so far of unknown, or at least uncertain, etiology, and that "the short attacks of fever in the hot and rainy season," from which most people suffer, are specific, but not malarial. Of these, Major Rogers describes "seven-day fever," the commonest fever among Europeans in Calcutta, Bombay, Madras, and Rangoon, but not known as yet to prevail away from the coast. It is a disease of comparatively little significance as regards prognosis, characterised by symptoms which are somewhat analagous to those of dengue. The onset is sudden, the face is usually flushed, and the general aspect dull and listless, simulating that of typhoid. Pain in the back is early and constant, headache is very constant and distressing, the pulse is slow in proportion to the temperature, as in typhoid. Rashes are seen occasionally, but only in a small proportion of cases (rather over 7 per cent.), and almost always appears on the fourth to sixth day, and not after the decline of the fever. The temperature curve shows a characteristic "saddle back," when seen in a typical case, while this also depends on the stage at which the patient comes under observation. Some of the charts are exceedingly like those of typhoid, especially, as pointed out by Major Rogers, Nos. 70 and 71. Convalescence is rapid after the temperature has become normal. The essential features in the blood changes are a diminution in the polynuclears with an increase in the lymphocytes and large mononuclears, the total leucocytes being much reduced. This resembles the change in the blood found by Carpenter and Sutton, by Still (mentioned by Rogers), and the later results of Asburnham and Craig. In six cases during two seasons work Rogers found an organism in pure culture which appeared to be related to the coli group, but differing from the organisms of typhoid and paratyphoid. Clumping "was not sufficiently constant to furnish a reliable diagnostic measure." Rogers does not do more than record the finding of this organism; he points out that if further research shows this to be the cause of the fever, "this will prove the disease to be quite distinct from dengue." On the present evidence, in view of the striking similarity

between the two diseases in so many respects, no definite conclusion appears to be possible. As for the "three-day fever" of the hot season in upper India, also described here, "there appears to be sufficient evidence to show that there is a common short non-malarial fever of the hot season in the drier tropical parts of Upper India, although it appears to be much rarer in the moister climate of Lower Bengal and Southern India." The temperature-curve is said by Rogers to be "characteristic"; the charts reproduced, however, hardly convey this impression, they might well represent almost any ephemeral fever, the only specific point is the limited duration, a feature not altogether free from fallacy.

With regard, then, to Major Rogers' first proposition, the clinical diagnosis of a large proportion of fevers in the Tropics, he has stated the points which are recognised as important, by any one of some experience, in a very lucid way, with perhaps more of a quantitative result than is usually available, and a knowledge of his work will be very useful to those who are beginning their experiences in the Tropics. But the debatable ground remains as wide as ever; clinical diagnoses or suggestions must in a large proportion of cases be supported by laboratory methods.

Major Rogers also describes "for the first time" "the fever which constitutes the pre-suppurative stage of amœbic abscess of the liver and its rapid cure." This is his other great proposition. Major Rogers, in 1905, discussed the importance of leucocytosis in acute hepatitis, and concluded that its presence in a slighter degree was possible, without actual suppuration having occurred. He has since found that a group of cases exists in which there is a chronic fever, intermittent, with no very definite symptoms of hepatitis, and rarely with any dysentery. In these there is a moderate degree of leucocytosis, generally of the type described by him in amœbic abscess, *i.e.*, where the percentage of polynuclears is only slightly in excess. Now this form of fever, with or without concomitant dysentery, yields rapidly to large doses of ipecacuanha. Major Rogers supports this view by a series of cases and charts, which appear to be satisfactory evidence. The verdict in such a case as this must depend largely on the practical results; these have, in fact, been good. Controls in such a matter are almost impossible, and when one remembers the extremely insidious nature of the primary disease, amœbic dysentery, and the equally insidious onset of the complication, one can only be grateful for another means of attempting to deal with a type of case which is always troublesome. The more one sees of the good results where (as by Rogers' process of quinine injection) there is a limitation of the possibility of secondary infection of the liver, the more one is inclined to try any method which avoids this possibility altogether. Nor is there, at least in India, or in Indian cases, any danger from delay; this method can and should be adopted at a stage before any exploratory puncture is at all justifiable. Whether this method is of universal application is another question; there seems to be no doubt that ipecacuanha is not always nor everywhere a specific for amœbic dysentery, some observers, indeed, hold that it is not only useless but dangerous in this infection.

Major Rogers also includes an interesting historical introduction, or account of the progress of our knowledge of Indian fevers. There are also included his Milroy lectures on Kala-azar (amplified), on which

disease he has done so much work, and an article on the effects of heat, of which part, in substance, has recently been published in the Journal. He also deals with several other subjects of varied importance.

Major Rogers' book forms a valuable guide to those who are beginning their service abroad. He is a prolific writer, and one is at times inclined to think that the output is greater than can be managed satisfactorily. In so great a quantity of material there are almost unavoidably points on which one must disagree with him, and points on which he appears to be misinformed. But one always admires his indomitable energy and the zeal with which he attacks many and varied problems, and in this particular instance we have to thank him for work which, like most of his, is interesting, suggestive, and often valuable.

R. J. S. Simpson.

Syphilis in the Army. By Major H. C. French, R.A.M.C. London: John Bale, Sons, and Danielsson, Ltd. Royal 8vo. 134 pp., cloth boards. Price 6s. net.

In the preface the author says that this work is an attempt on his part to show the detailed working of preventive medicine in the Army, and as a record of such it undoubtedly contains much valuable information; but it goes beyond being merely a record, as it enters into the question of the treatment of syphilis generally, and we are given what purports to be the usual means of treating the disease, besides the author's own views on the way of dealing with syphilis.

As regards the first, it can be clearly stated that the inunction method is not used in the Army in anything like a routine way for various reasons, but is reserved for certain cases. The description given of the necessary technique of this method is, to say the least, crude and antiquated when compared with the way it is carried out at Aix, Wiesbaden, and at Rochester Row, London. The intramuscular method, which is the one employed in nine cases out of ten in the Army, is dismissed in a few words; and it is stated that metallic mercury is now "ordinarily discredited on the Continent for injection purposes," the writer being evidently ignorant of the conclusion come to last year at a meeting of the French Dermatological Society, *i.e.*, that metallic mercury is to be preferred for intramuscular injections to any of the mercurial salts, and also that at the present time it is more in use in Berlin, Vienna, Milan, and Paris than ever, as it is now a well-established fact that from its slow absorption and elimination, metallic mercury is by far the most effective form of the drug in preventing the reappearance of the *Spirochæta pallida* in the tissues.

At p. 41 the author says, "To out-patients I would prefer to give potass. iod., 10 grains, t.d.s., but for purely Service reasons the man usually receives intramuscular injections of mercury." This is a curious admission to make, and we can hardly understand what Service conditions could or should ever influence a medical man so as to make him substitute mercury for pot. iod. when he thought the latter was indicated. In any case, why give pot. iod. in the absence of symptoms, unless one is a believer in it as a "preventive" of syphilitic recurrences, which is contrary to all modern notions.

No mention is made in the book of the necessity for giving potass. iod. in short intermittent courses; on the contrary, the author is evidently, from what he says, a believer in giving it in the old way, *ad infinitum*, in conjunction with liq. hydrarg. perchlor.; nor is anything said about substitutes for potass. iod.

The following extraordinary statement is made on p. 53, "syphilis is essentially a disease, when we treat symptoms and at the same time lay the flattering unction to our souls that we are treating the cause, &c." This is exactly the line of action which has brought discredit on the way syphilis is treated in England generally, but we had hoped that at least among Army surgeons "symptomatic treatment" of the disease had long since ceased, as it has on the Continents of Europe and America.

We cannot help regretting the appearance of this work, as, coming from the source it does, it is only too apt to mislead the profession generally as to the methods which have been and are being used in treating syphilis in the Army, and which have been followed by such brilliant results.

F. J. LAMBKIN.

PROTOZOA AND DISEASE. Part II. By J. Jackson Clarke, M.B., F.R.C.S. London: Baillière, Tindall and Cox. 138 pp. Price 7s. 6d.

We must confess to having read the second part of Mr. Jackson Clarke's book with a certain amount of disappointment. In the preface the author rightly emphasises the importance attaching to recent work in protozoology in connection with the light which this work has thrown on many of the dark places of pathological knowledge, but as the professed aim of the book is to outline this work for those who are unfamiliar with it, it appears to us that the want of proportion in the treatment accorded to the various parasites will militate against its usefulness. In the earlier chapters a good account of some of the recent work in connection with such diseases as sleeping sickness, kala-azar, piroplasmosis, &c., is given, together with a summary of the observations of Schaudinn on the *Spirochæta ziemanni* and the *Trypanosoma noctuæ*, which have given rise to so much controversy. By far the larger portion of the book, however, is given over to a description of the author's personal observations on certain cell-inclusions which he observed in sections of cancerous tumours as far back as ten to fifteen years ago. Numerous illustrations accompany these descriptions, but do not greatly lessen the difficulty of following the latter. These cell-inclusions he believes to be protozoa, and to be the cause of cancer. So elaborate a piece of special pleading appears to us to be rather out of place in a work of this nature. In the case of syphilis, which is the subject of a separate chapter, the spirochete of Schaudinn and Hoffmann is described, although incorrectly named, and the author attempts to reconcile this organism with certain intracellular bodies which he himself described some years ago. After concluding the reading of this chapter, it is even more puzzling to understand the meaning of a sentence which occurred at the beginning of the book than when it was first read. "It may, of course, be coincidence that Schaudinn discovered mobile spiral threads that he regarded as

protozoa, ten years after I had described as protozoa certain hyaline and cell-like bodies in syphilitic tissues." Guarnieri's bodies are spoken of as having been definitely proved to be the cause of small-pox and vaccinia, a statement hardly justified at the present moment.

Current Literature.

The Annual Report on the Health of the Army of the United States, America.—The Annual Report of the Surgeon-General of the United States Army Medical Department for the year 1906 has just been published, and, as usual, it is full of concise and interesting details. The forces with which it deals consist of enlisted American troops only, white and coloured. Statistics for native troops, Porto Rican and Filipino, are given separately. The average strength for the year was 56,443, distributed as follows: 40,621 in the United States, 805 in Alaska, 1,123 in Cuba, 12,380 in the Philippines, 232 in Hawaii, and 1,282 on board ship. The Cuban average strength is obtained from a force of about 4,491 that occupied the island during the last three months of the year only. The admission-rates for all diseases and injuries were 1,179·93, 714·29, 1,166·52, 1,700·32, 1,000·00, and 758·19 per 1,000 for these geographical areas respectively; and the death-rates: 5·28, 6·46, 2·40, 9·11, 8·06, and 7·02 per 1,000. These give an admission-rate for the whole army of 1,276·88, and a death-rate of 6·11. The constantly sick rate was 49·79, and the average days under treatment for each soldier 18·17, and for each disease 14·23. The admission and death-rates show a considerable decline as compared with the rates for the period 1898 to 1904, but only a very slight decline as compared with the previous year. Venereal diseases caused the greatest amount of inefficiency, namely, an admission-rate of 190·44 per 1,000, and a constantly sick rate of 13·09. Next came malarial fevers, with an admission-rate of 101·66. As compared with foreign armies, the most striking series of statistics are those of alcoholism, which in the American Army gives an admission-rate of 31·22 per 1,000. No other army, except the British, which had an admission-rate of 1·9, shows a higher rate than 0·29 per 1,000. This is all the more remarkable as no beer, wines or spirits are allowed to be sold within barrack precincts in the United States. The enteric fever admission-rate was 5·66 per 1,000, and the death-rate 0·28 on the continent. The rates in the Philippines were less, namely, 3·88 and no deaths; but the report states that the disease is increasing there, being higher than in 1905 and more than twice as great as in 1904. In Cuba the enteric incidence was 5·48 per 1,000, 65 cases having occurred during the short period of occupation. The report on the outbreak emphasises the facts that the disease was disseminated by personal contact, and that

its origin could be traced to the manœuvre camps at which the troops assembled previous to proceeding to Cuba.

The report contains very full and valuable tables of comparisons with other armies, tables of height, weight and chest measurements of recruits, according to age and race, and numerous illustrative charts.

In connection with sanitation, the steady increase in malarial fevers is noted, and in this respect the report states that it was found, as a result of special investigation, that practically nothing had been done in the Philippines for effectively screening against mosquitoes, and that in one department at least not even a single hospital was screened. The importance of this measure is not only urged, but recommendations were also made that all stables at military posts should be provided with fly-proof manure bins, and that "manure be so treated, handled, and disposed of, as to prevent the breeding of flies therein." A board for the study of tropical diseases was appointed, and amongst its investigations during the year has been the discovery of a new blood parasite, the *Filaria philippensis*, which is not pathogenic, and is common among the inhabitants of the Philippines. Its presence and life-history in *Culex fatigans* have been demonstrated. The board also found *Entamœba coli* among a very large percentage of American soldiers producing no symptoms of disease. An exhaustive study of dengue failed to discover any organism in the patients' blood, but the disease could be reproduced by injections of the blood, both filtered and non-filtered, of dengue patients into healthy individuals, and it was proved to be transmitted by *Culex fatigans* and not to be contagious.

Amongst important sanitary changes that are taking place, the M'Call incinerator is mentioned as having been adopted as the standard method of disposing of excreta in camps, and it will gradually replace the Reed trough, which, it may be remembered, was first introduced in connection with the repatriation camps in San Francisco after the war with Spain. Seventy-five of these incinerators were issued during the year and favourably reported upon. A new type of field filter has also been tried, and several have been purchased for further trial. The German wheeled water-steriliser was tried in Cuba, but certain defects in design are likely to prevent its general adoption. In the camps of instruction, opened during the year, the use of sanitary squads was a new feature. The squads were composed of non-commissioned officers and men of the hospital corps, and of civilians hired by the quartermaster's department, and handed over to the medical department. Their duties were to sterilise water, dispose of excreta, refuse, &c., destroy mosquitoes and flies, and carry out other details of sanitation. They are said to have been a great success, and a permanent organisation of this character is contemplated. Shower baths were used in all the camps and were of great value.

The report brings out very clearly the great deficiency of trained army medical officers in America. The total number was 302, or 21 below authorised establishment, and 166 contract surgeons had to be employed to carry on the ordinary peace work of the troops. Only ten student candidates and one Militia medical officer attended the Army medical school during the year. This is the smallest number since 1900, and the report states that the Army Medical Service has obviously lost much

of its attraction for the graduates for the best medical schools. Thirty contract dental surgeons and ninety-nine army nursing sisters were employed.

The general report also gives details of additions, &c., to the well-known Army medical museum and library, the latter now containing 162,295 volumes, and 285,933 pamphlets. Statements of medical and surgical supplies and general statistical tables conclude this excellent report. W. G. M.

The Standard of Vision required in the American Army.—In Circular No. 4 of the U.S. War Department, dated Washington, January 24th, 1908: "The following minimum visual requirements for recruits are announced," to supersede such of the previous regulations as are in conflict with this circular. The requirements are as follows:—

"(1) For the line of the Army, and for the Signal Corps: $\frac{20}{40}$ for the better eye, and $\frac{20}{100}$ for the poorer eye, provided that no organic disease exists in either eye.

"(*a*) Recruits may be accepted for the line of the Army, when unable with the better eye to correctly read all the letters on the $\frac{20}{40}$ line, provided that they are able to read some of the letters on the $\frac{20}{30}$ line.

"(2) For the Ordnance Department and for the Hospital Corps: $\frac{20}{70}$ in each eye, correctible to $\frac{20}{40}$ with glasses, provided that no organic disease exists in either eye."

These regulations, then, differ from ours in two points: firstly, in recognising the adaptation of the minimum to the requirements of various branches of the Army, and secondly in the admission of recruits *known* to be slightly astigmatic. The adaptation of the minimum is practicable because the standard as a whole is higher than ours, even the lowest permissible naked eye vision, $\frac{20}{70}$ corrigible by glasses in the case of the Ordinance Department and Hospital Corps, is slightly higher than that provided for in our regulations, where the minimum (where both eyes are ametropic) is $\frac{6}{24}$. In the line and signal corps, the correction by glasses does not appear to be contemplated.

There is much to be said for this principle of variation of the standard according to requirements. With our present low minimum it is not probable that any alteration would diminish the number of rejections for defective vision (28·64 per 1,000 recruits on inspection and within three months after enlistment in 1906, during which year the new system of examination was only in use for about three months), but it would ensure that those branches of the service in which good distant vision is essential, *e.g.*, the cavalry, artillery, and signallers, were possessed of better eyesight than may now be the case. It would probably involve some little administrative complication, but the result would be worth the additional labour.

The second difference is in the admission of men who are *known* to be slightly astigmatic to the line (not the Signal Corps), under the conditions of para. 1 (*a*). Even this relaxation leaves the minimum slightly above our standard.

The interest of this circular No. 4 lies, however, rather in the accompanying reports than in the actual instructions. It has been somewhat hastily assumed in preparing the regulations as to standards, that a clear

image of the target is always essential. A report by Major Shaw, of the Medical Department, U.S.A., attached to this circular shows, firstly by reference to authorities, and secondly by the results of experience, that this assumption is erroneous. Helmholtz (p. 127 of the last German edition, about 1893) pointed out that superposition of the centres of one object, and the diffusion circle from the other, or of two diffusion circles, was all that is necessary. Schmidt Rimpler, Seggel, Dor and Guillery, all agree that it is more important for the man to see the sights, especially the front sight, than the target, and that a diffused image of the target is no bar to excellent shooting. This would give, as the range of vision required, a myopia where the punctum remotum lay on or near the front sight, and a hypermetropia or presbyopia where the near point lay on the back sight.

Major Shaw shows from the results of experience "that in aiming :—

"(1) The diffusion image is furnished by the bull's eye as shown :—

"(*a*) By the relatively large number of expert riflemen who are ametropic.

"(*b*) *By actual experiment in target practice with riflemen whose vision has been artificially lowered.*"

(*a*) Experience shows that good sight is an accidental qualification of the marksman, not an essential. Shaw quotes authorities and observations which lead to this conclusion; some of the examples quoted are very striking.

(*b*) Experimental rifle practice with vision blurred by the addition of convex glasses till the acuity was reduced to $\frac{20}{40}$ or even $\frac{20}{70}$, was carried out by ten men who had good shooting records, and whose unassisted vision and refraction had been carefully determined. Each man had five shots for practice, then five shots without glasses, five with vision reduced to $\frac{20}{40}$, and five with $\frac{20}{70}$. The possible being 25, the average with naked eye vision was 18·7, the average with reduced vision (as above) was 19. The averages all through the series are indistinguishable, whether with or without reduced vision. Here the target undoubtedly furnished the diffusion image, on the centre of which the sights were aligned.

(*c*) Experience of rifle shots show that when the near point has passed beyond the rear sight, the shooting falls off until the necessary correction by glasses is made. Cases are quoted.

(*d*) Hypermetropia is shown by the fatigue in shooting, and the sudden failure owing to blurring of the image of the sights; this is, of course, removed by proper correction. Cases are quoted here also.

Our present standard of $\frac{6}{24}$ for two ametropic eyes is not far removed from the $\frac{20}{70}$ which under the conditions quoted above was found not to be incompatible with good shooting, 0·25 as against 0·286, so that little alteration would appear to be needed. But, as asked by Major Shaw, is this one standard suitable for all varieties of ametropia ?

(1) Astigmatism is a most common defect in riflemen whose acuity is below normal, but who are good shots. These cases have sufficiently good vision in one meridian, as is seen in their selection of letters from various lines in reading the types.

The nature of the defect is, of course, of great importance in relation to the form of sight used. Where normal astigmatism exists, a bar sight would give better results than a V sight; probably a pin-hole or orthoptic

would be useful in all cases. But it does not appear possible in practice to alter the individual sight to suit the vision of the user of the rifle. Hence the actual astigmatism is of little importance, so long as the recruit has the minimum acuity required by standard. One can imagine a state of things where the refractive error of each recruit was determined by accurate methods, and the sighting apparatus (or correcting glasses) necessary to get the best results prescribed in accordance with the result of this determination, but this can never be a practical method.

(2) Hypermetropia is certainly the most important defect, not only in frequency, but in practice. There appears to be a consensus of opinion that a *total* hypermetropia of 4D should exclude. This implies the examination of the eyes under atropine, as the relation between the manifest and latent hypermetropia is by no means constant in practice, even in men of the same age. It is to be considered whether or not all recruits with only the minimum standard of vision should be examined under atropine, their refraction accurately determined, and those with errors above a total hypermetropia of 4D rejected under the three months rule, or retained for service with "non-combatant" branches.

During the South African War hypermetropia caused a considerable amount of trouble, from the constant straining for a distinct image, though the actual admissions to hospital for errors of refraction were not great.

(3) Myopia is less common and less important in practice. It is among the myopes that the cerebral element, the true interpretation of imperfect images, is most valuable, nor, in the minor degrees which will pass the standard, is there any great probability of a deterioration with age. Major Shaw's conclusions are :—

(1) Good visual acuity is required in one eye only, as aiming is a monocular effort.

(2) In aiming the essential is "that the function of accommodation shall remain intact," hence the ill-effect of accommodative asthenopia (in hypermetropia) and presbyopia, which is, of course, relative to the refractive error.

(3) Ametropia which does not cause a blurred image of the sights is not incompatible with good shooting.

A further report of experimental work on the range by Lieutenant-Colonel J. M. Banister and Major Shaw is appended, which bears out the conclusions stated above.

These conclusions are important, not only in relation to the recruit, but in relation to the trained soldier who is ametropic. There is no reason at all why in the latter the refraction should not be accurately determined, and his disposal regulated accordingly. Men should not be invalided for ametropia, unless the refractive error is such as to lead infallibly to the reduction of acuteness of vision below the standard. It is, of course, difficult, if not impossible, to state with precision the degree of ametropia which will produce a definite reduction of vision, but a fairly good idea of the individual reluctance to see may be obtained by the careful estimation of the refractive error, its correction, and the record of the acuteness afterwards. If in a healthy eye, in an uncomplicated error, after correction the patient still declares that he cannot read $\frac{6}{6}$, then one is usually justified in saying that the refractive error

will not account for the whole inability to see, that this is probably in part voluntary. The evidence will never be strong enough to justify a charge of malingering, but the man may be sent to his duty as "fit." He should certainly not be invalided.

R. J. S. S.

Alterations in Nagana Trypanosomes by Passage through Hedgehogs. T. Fellmer (*Centralblatt für Bakteriologie*, December 20th, 1907). —The results of the author's observations may be summed up as follows: Hedgehogs are particularly susceptible to the trypanosomes of nagana. In the hedgehog the trypanosomes become altered, first as regards their appearance, and secondly as regards their virulence for rats. This diminished virulence cannot be exalted by subsequent passaging through rats; it steadily declines. Guinea-pigs appear to be resistant to strains of trypanosome which have been passaged through a hedgehog. The trypanosomes of *mal de caderas* retain their virulence for guinea-pigs in spite of passaging through hedgehogs. Immunisation experiments with these weakened strains of trypanosome have up to now given a negative result.

A. I. Fortescue.

The Treatment of Experimental Nagana.—In the *Deutsche Medizinische Wochenschrift* for 1907, p. 1361, Loeffler and Rühs give an account of the results of treating experimental nagana with arsenious acid. One gramme arsenious acid is dissolved in 10 cc. normal salt solution by boiling, the solution being subsequently neutralised by the addition of 10 cc. normal hydrochloric acid. The lethal dose for an animal of 1 kilogramme was found to be one-third more than the curative dose. The best results are obtained by the administration of the medicinal dose at fifteen-day intervals, either by the mouth, intravenously or into the peritoneal cavity. From three to five repetitions of this treatment cured guinea-pigs, rats and rabbits, infected with a nagana strain which caused death in five or six days in untreated cases. By a repetition of the medicinal dose at fifteen-day intervals, guinea-pigs can be prevented from developing symptoms, in spite of repeated infection.

A. I. Fortescue.

The Prophylaxis of Plague.—Under the heading "Personal Precautions in the Prophylaxis of Plague," the *All India Hospital Assistants' Journal* for January and February, 1908, gives the following admirable advice: "If dead rat is found in any part of house, do not approach him with neglect; as I have said before, fleas will catch nearest guest and victimise him. Our Indian custom of washing floors with a solution of cowdung is to be abandoned. The best will be to use ordinary water, and, if anything has to be used at all, choose the lesser evil. Immediately you find rat dead or dying, never be wavering, but clear out of house to nearest friend or relative. Sleep on cots at nights. Many rats that are infected die at nights. Besides, rat fleas are nocturnal excursionists, and when rat is dead and gone, they come to men to feed upon them. If you sleep on cots, there it less chance of their hopping up on you. They are not good

jumpers. If you evacuates your abode, do not occupy same until subsidence of epizootic. Rear cats. Educate your females in line of your thought to secure co-operation in prophylaxis."

A. I. Fortescue.

Correspondence.

"WHEN IS A MAN DRUNK?"

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—During the recent Royal Artillery Practice Camp at Birsandra, near Bangalore, a certain Serjeant F., R.F.A., was charged with "drunkenness on duty" by one of the Subalterns of his Battery. The accused denied that he was drunk, and claimed to be medically examined for the purpose of ascertaining his condition. By the orders of his Commanding Officer, he was seen by three other Non-Commissioned Officers, who all agreed that the man was drunk, but Serjeant F. still persisted in being medically examined, and eventually, with the permission of the Officer commanding the Battery, was brought to me to give my opinion as to whether he was drunk or not. He was seen by me within a quarter of an hour of the time that he was accused by the above of being drunk. On examination he was found to be quite rational mentally, his intellect being neither excited nor dulled. He stated, quite calmly, that the officer had abused him, using insulting language (which he repeated), because he was shooting badly, and that he got angry and said, "Beg your pardon, Sir, but that is not the way for an Officer to speak to a Serjeant"; whereupon he was told that he must be drunk, with the result stated above.

On further examination, his speech was quite normal; he was able to say such sentences as "Round the ragged rocks, &c.," "West Register Street," and so on, without any slurring or difficulty. There was no loss of equilibrium; he was able to stand with his eyes closed and his heels and toes together; his powers of co-ordination were good; he could touch the tip of his nose with the tip of his index finger with his eyes shut, &c. His hands, when held out, were not tremulous. His tongue was somewhat furred, and his breath "smelled of alcohol." He admitted that he had been drinking the day before. My reply to the Officer Commanding stated "that in my opinion Serjeant F. was not drunk, and that he was capable of performing his full duties."

The next day I was asked by another Officer if I was aware that testing men for drunkenness was forbidden by the King's Regulations. I said that I was well aware of the regulation quoted (paragraph 446 K.R.), which states: ". . . . Soldiers suspected of being drunk are not to be put through any drill or tested for the purpose of ascertaining their condition . . . " but that I believed that this did *not* refer to *medical* examination; the meaning of these words was clearly that Regimental Officers were not to put their men through any drill or tests, such as walking along a line marked out on the parade-ground, especially in public, as such a procedure would only put the man in question to ridicule, &c.

In spite of my medical statement to the effect that the man was not drunk, he was brought up for trial by District Court-martial on a charge of "drunkenness." At the Court-martial I was called to give evidence as a witness, when I stated, as before, that there was no loss of equilibrium, that his powers of co-ordination were perfect; that mentally he was quite natural, being neither excited nor dulled, &c., and that in my opinion he was not drunk. The President asked if I thought he could have been drunk within an hour of the time that he was seen by me, to which I replied "No." The same Serjeants as before gave evidence to say that he was drunk, but could give no reason beyond saying that he "looked drunk."

The prisoner was acquitted.

In connection with this case I would like to know:—

(1) If there is any medical or legal definition of drunkenness?

(2) Does paragraph 446 K.R. forbid medical examination?

(3) Can a soldier claim to be medically examined for drunkenness?

Yours, &c.,

D. G. C.

P.S.—Serjeant F. died in hospital within a month of the above incident, from liver abscess. He had no signs or symptoms of hepatic abscess at the camp. Probably he had pain in the liver, about which he did not complain, but which made him irritable and short-tempered.

D. G. C.

see page 692

SYPHILIS IN THE ARMY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In a recently-published work by Major H. C. French, R.A.M.C., entitled "Syphilis in the Army," I notice a statement which I write to correct. The author says, "I do not agree with the opinion of Colonel Lambkin that no advantage is to be expected from other modes of treatment of syphilis without mercury," thus attributing to me an opinion which I never held. On the contrary, in my lectures and writings on the treatment of the disease, I have always pointed out that not only do certain cases of syphilis benefit very much when all mercury is suspended and they are treated solely by hot-air baths, &c., but I have quoted many cases of undoubted syphilis within my knowledge which have apparently recovered without any specific treatment whatsoever.

I should feel much obliged if you can find space for this letter in the columns of the Journal.

I am, yours faithfully,
F. J. LAMBKIN,
Colonel, R.A.M.C.

Paris,
March 27th, 1908.

REGISTRATION OF LANGUAGE PROFICIENCY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—With reference to the letters of "J. R. W." in the February number, and of Lieutenant A. I. Fortescue in the April number of the Journal, may I be permitted to quote my own experience as a reason for the possible reluctance of Officers of the Royal Army Medical Corps to qualify for the certificates of proficiency in Foreign Modern Languages?

Four times I was refused permission even to enter for the examinations; and when at last I was graciously permitted to do so, it was on the clear understanding that I was not to be eligible for any rewards if successful. At last I was allowed to compete (in 1888 or 1889), and I then headed the list over twenty-six competitors in *French*, only two of us obtaining the "Interpretership" qualification. At the same time I obtained a "pass" in *Spanish*, and was the only one to score anything in that language. The following year I qualified for an excellent "pass" in *Italian*, and again I was the only candidate who scored anything in that language.

My certificates were duly registered at Headquarters, but I was so disgusted at the way in which I was ignored on two suitable occasions which soon occurred (for I was then the *only* Army Medical Officer *officially* qualified for that particular work) that—contrary to the advice

of my then General Officer—I declined to try for any more honours either in *German* or *Portuguese*, although I was morally certain of scoring again.

I spent nearly £400 altogether in acquiring these languages, and was quite an expert, in my day, as to the medical arrangements of the French, German, Danish, Spanish, and Italian armies. But I had the misfortune to be ahead of my time, and so was not wanted.

Again, in 1902, when Senior Medical Officer at Belfast, I noticed that my name had been omitted from the list of "Interpreters" in French, and on calling attention to the fact I was informed that, as my name had been left out, I should have to compete again. Nothing daunted, although I was then acting as Principal Medical Officer of the Belfast District, in addition to my other work, and with no time for study, I went up to London and again qualified as "Interpreter" in *French*, this time with 88 per cent. of the total possible marks; but once again nothing came of it.

Only once were my services called for as an interpreter, when I successfully pulled my General Officer Commanding out of a scrape with a foreign Admiral (which his own Aide-de-Camp had let him in for), and then my Principal Medical Officer was thanked for the loan of *my* services (as if I were a spare charger), and the hope was expressed that this had not interfered in any way with the medical work of the Station, but I myself was taken no notice of. This treatment was the talk of the garrison in both Services, Naval and Military.

Briefly stated, my experience all through my service was that foreign languages were of no possible advantage whatsoever to the Army Medical Officer; and this was one of the chief reasons for my retiring from the Army, utterly disheartened. Fortunately for those now entering the Army Medical Service, things seem to have changed for the better in every way since my day.

I am, Sir, yours faithfully,
J. E. NICHOLSON,
Lieutenant-Colonel, *R.A.M.C.* (*R.P.*).

Villa Santa Rosa,
Douglas, *I.O.M.*,
April 7th, 1908.

A NEW METHOD OF CARRYING WOUNDED OFF THE FIELD ON SERVICE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—It will probably be of interest to readers of the Journal to hear that the method of improvising a stretcher with two rifles and puttees (described by Captain J. S. O'Neill, I.M.S., in the April Journal) was used with very satisfactory results on several occasions during the

relief of Ladysmith, when, owing to the number of wounded, the supply of ordinary stretchers ran short.

Very good stretchers were also made by tying waterproof groundsheets to rifles by means of puggarees taken from the men's helmets. The puggaree also makes a very good bandage, and was frequently used by the men for binding up their wounds.

I am, dear Sir, faithfully yours,

J. J. W. PRESCOTT,
Captain, R.A.M.C.

Royal Military Infirmary,
Dublin.
April 10th, 1908.

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of the

Royal Army Medical Corps.

Original Communications.

DISEASES LIKELY TO OCCUR ON THE OCCASION OF THE MOBILISATION OF A TERRITORIAL ARMY.[1]

BY CAPTAIN W. SALISBURY SHARPE.
Royal Army Medical Corps (T.).

Constipation—Diarrhœa—Dysentery—Enteritis—Enteric Fever—Diphtheria — Measles — Pneumonia — Rheumatic Fever — Small-pox.

IT may be taken as certain that the mobilisation of a territorial force would be accompanied by a large amount of sickness, and that the cases would consist of a very wide variety of different diseases. Notwithstanding the immense variety of cases which would probably be met with in the first few weeks of a campaign, a very large proportion of them would fall into two main groups: those which are due to a common cause and those which are directly communicable from man to man. The common causes tending to lead to widespread sickness are unwonted exposure, change of diet, over-fatigue, extremes of heat and cold, unclean water, &c. From the point of view of treatment also the cases will fall into two groups, not identical with the former, Group 1 containing the specific infectious fevers and Group 2 containing all

[1] Paper read before the United Services Medical Society on April 9th, 1908, at the Royal Army Medical College, Millbank, the President, Inspector-General Sir Herbert Ellis, K.C.B., K.H.P., R.N., Director-General of the Medical Department of the Royal Navy, in the chair.

alvine disorders, including enteric fever. I have used the word "alvine" instead of "enteric" so as not to give the impression that I mean only diseases bacterially related to enteric fever. Group 1 would also contain general ailments not needing special measures of isolation.

The first thing to consider is the condition of the locality of the camp as regards water supply, available roads, proximity of railroads, towns, &c. I have heard it said, in connection with the training of the late lamented Volunteer Force, that, on account of the number of buildings of one sort or another all over the country, it would seldom, if ever, be necessary for a force operating in this country to use canvas for any hospital purpose. From this statement I beg to differ entirely. In the immediate neighbourhood of towns properly constructed buildings might be available and be found capable of adaptation, but in the open country, where the first line would usually of necessity be, few if any buildings would be found suitable or fit to be converted for hospital purposes. The choice would therefore usually lie between canvas and hastily constructed temporary or portable buildings. Some few private dwelling-houses might be available and suitable, or capable of being made suitable; school-rooms would also supply a limited accommodation in most villages; but churches, barns, and farm buildings would be less suitable than tents on account of the almost universal absence of any provision for the admission of light or for ventilation. Moreover, buildings of the latter class are usually placed in the midst of the most insanitary surroundings possible. Of course, in any case, all sanitary arrangements would have to be initiated *de novo* and carried out with the greatest thoroughness. Except in the immediate vicinity of a considerable town, a field unit would have to depend as much upon its communications and its own transport as if it were in a foreign country. A stationary hospital would, of course, be placed near such a town.

We shall proceed to consider the position of a field unit attached to an advanced body of troops in standing camp in an agricultural district such as may be met with in any part of England. There would be, as might be expected, much sickness, consisting principally of the diseases enumerated above. Such a camp as I have described would certainly be pitched upon grass land, close to or even intersected by a serviceable road, for the roads in rural England are both numerous and, up to their capacity, good. The actual site of the camp as well as its extent and position would be

determined partly by strategic necessities and facility of defence, or by the proximity of a good training ground, and partly by the extent and position of the water supply available. The water of most villages and farmsteads is obtained from shallow wells dug, as a rule, close to the houses, within a very short distance of a cesspool, and not infrequently pervious to surface drainage and to soakage from the liquid elements of the manure in the yard. The immediate inhabitants appear to have been immunised by a lifelong habituation to these conditions, so that they suffer no inconvenience, but with men from a town or from other conditions of life the case would be far otherwise. Moreover, these wells are, as a rule, of small output and incapable in ordinary seasons of yielding a sufficient supply for any large number of men and animals. It would be necessary, then, to look for another source of water, and this would most commonly be found in the form of small streams at no great distance. Such streams would require to be explored and any source of pollution stopped off, if possible; the stream would then need to be dammed at a convenient point, or its flow diverted into a dug pit with an overflow reverting to the original bed. Such water would require boiling or germ-proof filtration before it was sufficiently trustworthy to supply to troops for drinking purposes. An important and exceedingly reliable source of water in many places would be natural springs which either discharged of themselves or might be easily tapped. At all events, the conditions in this important particular are, as a rule, well known locally and would in no part of this country offer any insuperable difficulty.

Before proceeding to the consideration of the methods of dealing with separate diseases we must next give attention to methods of disposal of excrement and refuse. One of the most important objects to aim at in doing this is the avoidance of a plague of flies. This would be best accomplished by digging or ploughing all refuse into arable land in the manner laid down by the late Dr. G. V. Poore, care being taken that no part of the water-catchment area is thereby polluted. The plague of flies, the fourth of the ten plagues of Egypt, occurred shortly after the plague of frogs, when, as the Bible tersely and expressively puts it, "they gathered them," *i.e.*, the dead frogs, "together in heaps, and the land stank." I believe that I was the first to call attention to the important *rôle* played by flies in the spread of diarrhœic diseases, for in the Milroy Lectures on Summer Diarrhœa by Dr. F. J. Waldo, delivered in March, 1900, and published in the *Lancet* of May 26th, 1900, he

attempted to prove that the spread of epidemic diarrhœa was entirely due to dust conveyed by air currents. On the publication of this I at once (*Lancet*, June 2nd, 1900) wrote an article, from which I will quote an extract, stating my opinion that flies had at least as much, if not more, to do with the spread of the disease than air-conveyed dust.

I will quote :—

"I have read with much interest the Milroy Lectures on Summer Diarrhœa by Dr. Waldo, and consider that this evidence is as complete as the statistician or medical officer of health can make it, but there is one point concerning the means by which food becomes contaminated to which he barely refers, and to which I, as a practitioner, am inclined to give a very high degree of importance. The point to which I refer is the agency of flies in the direct conveyance of bacteria from filth to food. In making this remark I wish it to be understood that I do not desire to question in the least degree the immense importance of bacteria-laden dust, especially that derived from horsedung and other forms of excreta, with which the atmosphere of towns is at all times polluted, but I would like to point out that such dust is present at all times of the year when the streets and roads are dry enough to allow it to exist in the form of dust. Contamination of food by means of dust is, therefore, possible at all seasons. Of course, during hot weather the bacteria grow much more rapidly in food, milk, &c., than in cold weather, and are, therefore, more likely to be present in large numbers at the time when the food is ingested. The relative resistance of the gastro-intestinal canal to the action of such organisms or their products, and the question as to whether and to what extent climatic conditions affect such resistance, we must leave out of account, as we are arguing now on matters outside the human body. As a general practitioner of over eleven years standing, I have seen a good many cases of summer diarrhœa, and have no doubt of its being due to bacterial contamination from alvine evacuations, whether equine, human or other. I am inclined to think that human excreta have more to do with it than is recognised, the only question being the method of transference.

"According to Dr. Waldo's showing, the incidence of diarrhœa is not greatest in the large streets and thoroughfares which are most dung-laden, but in by-streets and courts. Now, if the disease were due mainly to direct contamination by dust, one would expect to find it most in the larger streets, where such dust as there is consists chiefly of horsedung and is kept constantly stirred up. The windows of the houses in such streets are, moreover, frequently wide open during hot weather. The dust has, therefore, free access to basements, kitchens, larders, &c. The bactericidal action of air, light, sunshine, &c., on town dust, must, as Dr. Waldo says, be considerable, but cannot be completely antiseptic.

I think that bacteria are more likely to be conveyed in an active and virulent state by flies, which settle at one moment on fresh dung and at the next on milk, meat, butter, sugar, jam or fruit, than by dust, which must, if emanating from dung, have been some hours exposed to wind, &c., to have become desiccated and pulverised, and to have reached its destination on the food, to say nothing of the strong sunshine to which it is likely to have been subjected at the time of the year we are considering in the process of desiccation.

"These remarks are based solely on observation, and that of no vast number of cases, as I have not practised extensively among the poor, upon whom the greatest incidence of infantile diarrhœa falls. Nevertheless, whenever I have seen the summer diarrhœa of infants, of all the varying conditions among which it makes its appearance, the one condition which has impressed me as being the most constant and invariable has been the presence and persistent meddlesomeness of the common fly. Granting that the dung of our streets supplies the *materies morbi*, may not the fly play as important a part as the wind-current in depositing it in an active state on our food?"

Nine months later, March 16th, 1901, came the able and exhaustive article by Dr. Tooth, in the course of which he blames both dust and flies for the spread of the disease :—

"On still days, even, it was rare not to be visited by a number of small whirlwinds called 'sand-devils,' which would pass slowly along sucking up quantities of sand and any light articles such as pieces of paper, carrying them to an astonishing height in the air and depositing them broadcast. The result of all this was that sand entered largely into every article of food, for the cooking was performed in the open air. The air at that time was intensely dry, so that it is not much to suppose that all sorts of fæcal and urinary contamination must have been disseminated with the sand and dust. The same state of things obtained at Bloemfontein, but in a minor degree, because the atmospheric conditions were generally quieter at that time of the year. As a factor, then, in the spread of enteric fever, we must by no means overlook sandstorms, which are everyday phenomena in many parts of the world where the British Army may be sent, and it is quite a question whether they have not been more important factors in the South African war than water itself. For that the water contained enteric fever bacilli is a matter of speculation, but that enteric stools and urine must have been deposited in the latrines and other places by men in the early stages of the disease there can be no reasonable doubt.

"*Flies.*—As may be expected, the conditions in these large camps were particularly favourable to the growth and multiplication of flies, which soon became a terrible pest. I was told by a resident at Bloemfontein that these insects were by no means a serious plague in ordinary times, but that they came with the Army. It would be more correct to

say that the normal number of flies was increased owing to the large quantities of refuse, dead horses, &c., upon which they could feed and multiply. They naturally infest persons who are ill, but seem to be peculiarly attracted to enteric fever patients, hanging in loathsome groups around their mouths and feeding-vessels. They were all over our food, and the roofs of our tents were at times black with them. It is not unreasonable to look upon flies as a very possible agency in spreading the disease, not only abroad, but at home.

"It is a well-known fact that with the first appearance of the frost enteric fever rapidly disappears. The winter in South Africa is very mild compared with that to which we are accustomed in England. It is true that the nights are cold, sometimes to many degrees of frost. But the days are warm and bright; for instance, in my tent at mid-day the temperature was rarely below 70° F., and sometimes as high as 80° F.—in fact, about the temperature of an English summer day. It seems hardly credible that the sudden cessation of an epidemic can be due to the effect of cold upon the enteric fever bacilli only, but there can be no doubt in the mind of anybody who has been living on the open veldt for three or four months, as I have, that flies are extremely sensitive to the change of temperature, and that the cold nights kill them off rapidly. On consideration of these points it is surely justifiable to assign an important share to flies in the spreading of infection."

Two months after this, on May 18th, 1901, appeared in the *Lancet* the important article by Dr. G. V. Poore on "Flies and the Science of Scavenging," which ought to be thoroughly known to every Royal Army Medical Corps officer, Regular or Territorial. To quote it all would take too much time, but I cannot forbear giving extracts:—

"As flies multiply upon, and in, organic refuse of every kind, it is obvious that the sooner such refuse is placed where it cannot serve for the feeding and hatching of flies, the more likely is the plague of flies to be lessened. The most commonly available method for the bestowal of organic refuse is burial. I have always advocated the burial of fæces in shallow furrows rather than in deep trenches, and, in this country at least, where alone I have had experience, I am convinced that this is the only reasonable course to pursue. If properly done, all offence to eyes or nose is thus ended and the fæces cease to attract either flies or rats. The fæces can be covered continuously as soon as they are dropped, and there is no need to have malodorous open trenches, partially filled, waiting to be completely filled before being covered up. This burial of fæces must be done methodically and carefully, and with every attention to detail. The proceedings must be precisely those of a gardener who is intent upon raising crops. The fact that in war the crops may never be harvested is quite beside the mark, and affords no excuse for slovenly procedures which are a danger to health. Nitrification in the soil is the aim equally of the sanitarian and the agriculturist. If a plot of ground

50 yards long and 50 yards wide—slightly more than half an acre—be allotted for the disposal of fæces, this should be marked off into, say, sixteen strips, each about 8 feet wide and 50 yards long, with a narrow path of about 18 inches between each strip to allow for watering and cultivation. No particle of fæces or paper must be left uncovered. There will be no offence to eye or nose, no putrefaction is possible, the fæces are beyond the reach of dipterous insects, and if there has been no delay in the collection and burial of the fæces they cannot have been used for oviposition to any great extent, so that the soil will not become infested with 'grubs.'

"How many men will provide the quantity of fæces which can be placed in a trench 8 feet long, from which 176 pounds weight of earth has been removed? The answer to this question is governed by bulk rather than by weight. If fæces and earth were equal in bulk for equal weights, and if we allowed a quarter of a pound of fæces for each man—for urine soaks away and *qua* bulk may be neglected—then the answer would be $176 \times 4 = 704$. If the fæces are, weight for weight, four times as bulky as the earth, the answer is 176. In any case it seems safe to say that a trench 8 feet long, 9 inches deep, and 7 inches wide, will suffice to take the fæces of 100 men. This estimate entirely accords with my experience gained in my garden at Andover, where the fæcal accumulations of twenty cottages have been disposed of daily in the manner indicated for eighteen years, and where it takes at least five years to cover an acre of ground in this way. Those who have not had experience of this method of dealing with fæces are apt to have exaggerated views as to the amount of land required. If a trench 8 feet long and 7 inches wide is sufficient for the disposal of the daily quota of excreta from 100 men, then ten such trenches occupying an area of 8 feet by 70 inches—say 6 feet—is enough for 1,000 men, and one strip of ground 50 yards long and 8 feet wide would serve for a regiment of 1,000 men for twenty-five days, and the sixteen strips would serve for 400 days, let us say ½ acre per annum per 1,000 men. The actual area necessary will depend to some extent upon the nature of the soil and the care and skill of the scavenger, but in no case can the area required be regarded as a bar to the process, certainly not on the veldt or on Salisbury Plain. It need not be insisted on that a scavenger must be incessantly at work. The excreta should be taken up as soon as dropped and be placed in a covered pail, and the pail when full should be emptied into the furrow and be covered up. In this way effluvia are stopped and ovipositing by diptera is rendered impossible. Further, this method of disposing of fæces necessitates no increase in the impedimenta of an army; no lime or chemicals are needed, and no apparatus beyond a spade and a set of garden tools."

Since 1901 the part played by flies in the spread of many diseases, but especially those of the alvine class, has become generally recognised, and further articles were written upon the subject last year.

The stationary hospitals should for many reasons be built or pitched quite near but completely outside a town of some size. They should obtain their water from the same sources which supply the town, but should if possible dispose of their refuse themselves, preferably either in the manner described or by deeper burial, rather than seek to connect up with the drainage system of the town, even supposing that to be reasonably accessible. The available hospital accommodation should be permanently divided into the following portions : Surgical, General, Medical, Alvine or Enteric, and Infectious, this last to contain all infectious cases not included in the alvine or enteric group. These departments or sections should, wherever possible, always be kept completely separate in separate buildings or sections of the encampment, and nursed by a separate staff of nurses or orderlies, strict rules being formulated for each and rigidly enforced.

In no part of the United Kingdom will a railway be many miles distant, and a temporary platform is easy to construct, and if necessary a siding also. The existing line of rails will for certain lead direct to the nearest town of any importance. The chief difficulty in this connection will undoubtedly be due in most places to the small carrying capacity of the line in proportion to the immense and unwonted needs of a large body of troops encamped in the neighbourhood. For this reason the Royal Army Medical Corps should retain under its own control all the transport to which it is entitled, as its mobility and capability of moving its patients will vitally affect the health of the Army. This point is not sufficiently appreciated by the Army in general, though well recognised by the Royal Army Medical Corps. I am sorry that I am not sufficiently intimately acquainted with the topography of any of those portions of the country usually considered to be vulnerable to an invading enemy, to be able to give a concrete example, as I quite realise that such a course would have made a paper far more interesting than the present one can be.

Having mentioned some of the conditions which would have to be met by any medical unit operating in this country in war-time, I will now proceed to consider means of dealing with the sickness occurring in a standing camp of recently mobilised territorial troops. Isolated cases of almost any known disease might be met with, but it is chiefly those liable to occur in widely spread outbreaks with which we are now concerned. As so large a proportion of the sickness of a camp is, and in all the campaigns of the past of which we have any record has been, due to diseases of the alvine class, and as the prevention of these diseases in particular is the

aim of most of the sanitary measures enacted and carried out in connection with camps, it will, I think, be well to commence the consideration of individual diseases by reviewing those of this class.

Constipation.—The first sign of disturbance of the normal digestive functions due to change of diet and circumstances of life on going into camp is very frequently constipation. This should be explained to the men, who should be instructed to report its occurrence early and apply for remedies, as there is no doubt that, in addition to the risks and discomforts incident to the condition itself, it often prepares the intestine for the incidence of other alvine diseases and diminishes its resistance to infection. If treated early, such cases will rarely need admission to hospital; but if not seen until several days have passed since the last motion, they will need admission.

Diarrhœa.—This commonest of all camp ailments often follows upon constipation, and, due to very varied causes, is usually the first symptom noted of the graver intestinal diseases to be mentioned immediately. All cases of diarrhœa should be reported and carefully examined, and, if accompanied by fever, admitted and kept under observation.

I am not going to say anything about the actual medical treatment of this or any of the diseases under consideration.

Dysentery, or, as perhaps some of you wishing to restrict this name to the specific tropical disease would prefer to call it, enteritis.—This, next to true enteric fever, is the most prevalent and important of the diseases incident to camp life. It is, of course, included in the alvine or enteric group, and the preceding remarks respecting camp sanitation, as well as the subsequent ones as to dealing with cases of enteric fever, apply equally to this disease.

Enteric Fever.—A remark was made during the late South African war by a civilian surgeon, who ought to have known better, that Royal Army Medical Corps officers did not know enteric fever when they saw it. Now anyone who knows anything about enteric fever is aware that the difficulty is, among the enormous number of alvine and febrile cases, to distinguish those which are *not* cases of genuine enteric fever, for if all cases were to be treated as such, which conceivably might turn out to be so later on, the military operations might in many cases as well be abandoned. Cases of enteric and other diseases should be at once isolated from all other cases of sickness, &c., kept in separate tents and buildings, nursed by a separate staff, and conveyed separately to a separate base hospital. If the sanitary measures I have detailed be efficiently

carried out there will be no need to spend time, fire and chemicals in disinfecting the dejecta themselves before disposing of them; the labour will be needed and will be better employed in careful scavenging. The element of dust storms and conveyance of infection thereby will not be likely to occur in this country, except in such places as Aldershot, where the measures I have described would not be likely to be adopted, as they presuppose a cultivable soil, which, in most places, there will be no difficulty in finding.

Diphtheria.—It is quite possible that an extensive outbreak of this disease might occur among troops in an encampment. Prompt injection of antitoxin is the most important procedure from the point of view of treatment; injection, with a smaller dose, of all contacts, together with an adequate supply of tents, so that the men should not be overcrowded, and of land, so that the camps should not be pitched upon a minimum area, would soon put an end to it. Cases of the disease would, of course, be isolated so far as not putting other cases into the same tent or apartment, and allowing plenty of air space or ventilation between them and their next neighbours, keeping the patients' utensils for themselves alone, &c., and disinfecting them when done with.

Measles.—This is a disease which, though not of high mortality itself, is very troublesome in large outbreaks, and is liable to cause many deaths. It is, of course, always with us, especially among children, but is rarely or never in ordinary circumstances epidemic among adults. The aggregation of large numbers of men, mostly young, in a standing camp, would be very likely to produce an outbreak. Cases should at once be isolated, and a small segregation camp formed for contacts and cases of undetermined febrile disturbance which might turn out at any time within a fortnight to be measles. No special case treatment is required, but the patients must be carefully shielded from exposure during and shortly after the fever, as they are extremely liable to bronchitis and pneumonia, from which causes most of the fatalities in measles occur.

Pneumonia.—It is now generally recognised that pneumonia is a true specific infective disease, and it has been known on many occasions to occur in definite outbreaks, very like other specific infective fevers. Good sanitation of a camp would do much to prevent this as well as other diseases, for it was proved many years ago that the pneumococcus multiplied in foul water, manure, and drains. Moreover, many of the diseases well recognised as due to such influences, *e.g.*, septic throats, acute tonsillitis, middle-ear suppuration, suppurating arthritis, endocarditis, &c., have been

proved to be due to the pneumococcus as often as any other of the pyogenic organisms. Pneumonia cases will not need special efforts at isolation if they can be given a sufficient air supply, as the degree of direct communicability is low. Such patients do best in an atmosphere neither too hot nor too cold, nor subject to great variations in temperature, and require a very free air supply. Though the average mortality of the disease is not very high, there are moments of danger in nearly every case, and it must always be reckoned as a grave disease. The severity and, consequently, the mortality vary immensely in different outbreaks, the difference appearing to lie in the actual nature of the infection and not in the individuals attacked, nor, in the attendant circumstances, to any large an extent. Pneumonia sometimes forms a very fatal complication to enteric fever.

Rheumatic Fever is again a specific infective fever of low direct communicability, but which might readily occur as a serious outbreak on the mobilisation of large bodies of men unaccustomed to camp life. Apart from their direct medical treatment, which I am not here discussing, the cases will need care on similar lines to those just mentioned under the heading of pneumonia; but as this disease is normally of much longer duration than is pneumonia, and is, moreover, subject to many and serious complications, *e.g.*, heart disease, &c., the patients should be handed over to a stationary hospital or to the care of the civilian organisations as soon as their condition would permit.

Small-pox.—A disease which we are apt to lose sight of in this country, on account of its comparative rarity, is small-pox, but in case of mobilisation it might become a very serious matter, for it is one of the weak points of the Territorial Force that, on account of its voluntary character, no provision has been made that its members shall have been recently and efficiently vaccinated. There is no systematic secondary vaccination in this country, and there are many escapes from even primary vaccination, so that the number of men susceptible would be large. Seeing how the available vaccine supply of the whole country broke down during the last scare about six years ago, it is very necessary to have a large supply of lymph ready should an outbreak occur or even threaten. The cases as they occurred should, of course, be at once rigidly isolated, and all contacts vaccinated, pending larger measures of vaccination.

Venereal disease, sunstroke, sore feet, and many other ailments would probably occur in considerable numbers; but I have spoken

of those which would be likely to occur in well-marked outbreaks, and to put special pressure upon the Royal Army Medical Corps and its sanitary service in dealing with them. It will be noticed that I have throughout considered the conditions of mobilisation and standing camp, and not actually of war, thus making my paper coincide with the proposal of Mr. Haldane, that some months should elapse (if your enemy is kind enough to permit it) between the mobilisation of the Territorial Force and its being led into action.

DISCUSSION.

Colonel WARDROP, A.M.S., doubted if we should have so much enteric fever as Captain Salisbury Sharpe anticipated: he thought that with carefully selected camps and men coming from healthy homes better results might be hoped for. Indian experience made him sceptical of the infallibility of an earth system of disposal, such as advocated by Dr. Vivian Poore and supported by the lecturer, in the absence of a highly-trained conservancy establishment.

Major W. S. HARRISON, R.A.M.C., regretted that Captain Sharpe had not referred to some of those sanitary measures which it is necessary to take in peace-time by way of preparation for war. It was one of the hardest things in the world to keep constantly before one's mind that the only object of keeping an army was to be ready for war, that the only time of preparation was peace-time, and that, if war came before one was prepared, it was then too late to make amends. In this respect the Regular Army was not without sin, for at the present moment anti-typhoid inoculation was being offered to men, not because one wanted to make them ready for war, but because they were going to an unhealthy country. Major Harrison wished he could hope that the Territorial Army would show an example to their Regular brethren in this respect. There was another point which seemed to him to be of very practical importance: A large number of members of the Territorial Force were in the habit of wearing light boots which would be quite unsuitable for campaigning, and when they came to use proper marching boots the majority of them would almost certainly suffer severely from sore feet. He suggested that commanding officers of territorial corps should keep this matter in mind, and try to invent some arrangement which would encourage their men habitually to wear boots which would be suitable for campaigning. It was not necessary that the boots should be aggressively military in pattern. A good shooting boot would do; and it might be worth while to make arrangements with local bootmakers to keep a stock of such boots of especially good value, which would be readily bought by the men for their private use.

Inspector-General Sir Herbert Ellis, K.C.B., K.H.P., Director-General of the Medical Department of the Royal Navy, proposed a vote of thanks to Captain Salisbury Sharpe, which was carried by acclamation.

REPORT ON FURTHER EXPERIMENTS IN CONNECTION WITH ANTI-TYPHOID INOCULATION.[1]

By Brevet Lieut.-Colonel W. B. LEISHMAN, Major W. S. HARRISON, Major H. W. GRATTAN, and Lieutenant R. G. ARCHIBALD.
Royal Army Medical Corps.

Standardisation of the Vaccine.

The method at present in use is a modification of Wright's method which was devised by one of us, the details of which were published in this Journal.[2] The technique has been simplified in the following respects: (*a*) It has been found unnecessary to stain the bacteria, as they are perfectly well seen unstained, especially if one examines the films by artificial light; (*b*) the bent tube is no longer used; in its place the volume of blood is taken up into an ordinary straight capillary pipette and washed into a centrifuge tube by means of citrate of soda solution in saline; the pipette which has been used for measuring the blood is kept on one side and is subsequently used for measuring the culture which has to be counted. It has been found that any difficulties arising from the motility of the organisms can be overcome by the addition of a trace of formalin (of a strength of two or three drops in 10 cc. saline) to the fluid in which the mixture of blood cells and bacteria is suspended. The results that have been obtained have been fairly uniform, and the error can be easily kept under $\pm$ 10 per cent. after a short experience of the method; it has, however, been found that, when tried by those unaccustomed to the procedure, the tendency is to under-estimate the strength of the culture.

Lamb and Foster's Method.

The authors of this method[3] aimed at measuring the strength of a vaccine by finding the smallest quantity of the vaccine which would remove the bactericidal power from a given quantity of normal goat serum for a given test dose of living bacteria. A series of experiments was undertaken to see if the principle could be

[1] The earlier experimental work, of which this is a continuation, appeared in articles by Lieutenant-Colonel Leishman and Major Harrison in the Journal of the Royal Army Medical Corps, May, 1907.

[2] Harrison, Journal of the Royal Army Medical Corps, March, 1905.

[3] "Scientific Memoirs, Medical and Sanitary Officers, Government of India," New Series, No. 21, 1906.

relied on for the practical estimation of the strength of a vaccine. We were not in a position to use goat serum, but substituted for it the fresh "pooled" sera of six normal rabbits, the principle being unaffected by this change. The process is a very laborious one, much more so than the counting method, and it was found that it could not be relied on for the detection of a variation of ± 25 per cent. in the strength of a vaccine. The following is an example of the results obtained. A forty-eight hours' culture of *Bacillus typhosus* was killed by heating to 53° C. for one hour and the following test vaccines were prepared from it :—

Vaccine A = undiluted.

Vaccine B = 3 parts vaccine A + 1 part sterile water.

Vaccine C = 2 parts vaccine A + 2 parts water.

Each of these was diluted to 1—2, 1—3, &c., up to 1—10; and the following mixtures made: 50 c.mm. fresh normal rabbit serum and 200 c.mm. of each of dilutions of the vaccine. The mixtures were incubated for one hour at 37° C. At the end of this time 50 c.mm. of a 1—1,000,000 dilution of a living twenty-four hours' broth culture were added to each; the mixture was then incubated for twenty-four hours, after which period the tubes were filled up with broth. The following were the results :—

Dilution	Vaccine A	Vaccine B	Vaccine C
0	Growth	Sterile	Growth.
1—2	Sterile	,,	Sterile.
1—3	,,	,,	,,
1—4	,,	,,	,,
1—5	,,	,,	,,
1—6	,,	,,	,,
1—7	,,	,,	No observation.
1—8	,,	,,	,, ,,
1—9	,,	,,	,, ,,
1-10	,,	,,	,, ,,

All the precautions prescribed by the authors of the method were scrupulously adopted in every experiment tried, and, as the results were unsatisfactory in every case, we were compelled to abandon the method.

Standardisation by means of a Photometer.

In these experiments an attempt was made to arrive at a method for standardising a vaccine by measuring the interference to the passage of light caused by placing in front of an electric lamp a flat-sided vessel, of definite thickness, filled with vaccine. The instrument consisted of a long board along which one could slide a carrier holding a paper screen, in the centre of which was a small grease spot made with a drop of castor oil. The ends of the

board were fitted with two Nernst lamps of equal power. When using the apparatus the point at which the two sides of the screen were equally illuminated (as shown by the disappearance of the image of the grease spot) was noted—(*a*) with both lamps unobstructed, (*b*) with a flat-sided vessel full of broth in front of one lamp and (*c*) with the same vessel full of vaccine. It was hoped that one might be able thus to arrive at a means of measuring the obstruction of light caused by the bacterial bodies in the vaccine, and from that to establish a means of standardising it. The apparatus was tested by comparing the influence of progressive dilution of a vaccine upon its opacity. It was found at first that the method gave very encouraging results, but, after more prolonged observations, the first promise was not fulfilled and the method was eventually abandoned because, although one might obtain consistent results over quite a long period, a very considerable error was shown every now and again, due partly to variations in the light from the lamps during the time of the experiment and partly to personal factors, fatigue, eye-strain, &c., in the observer.

Standardisation by Chemical Methods.

An attempt was made to discover a means of standardising a vaccine by an estimation of the chemical changes which occur in broth as the result of the growth of typhoid bacilli in it. A forty-eight hours' growth of the organism in broth was centrifuged till quite clear, and a chemical analysis made of the supernatant fluid and of the original broth. It was found that there was a rise in specific gravity, in free and albuminoid ammonia, and in oxidisable matter, as a result of the growth of the bacteria in the broth. The total solids were increased, but the residue, after incineration, was reduced, and chlorine was likewise reduced. The changes, however, were not sufficiently constant to serve as a basis for standardisation.

Experiments on the Effects of Various Experimental Vaccines.

Comparison of Vaccines Killed by Heat and those Killed by Lysol only.

As it had been found that 0·25 per cent. lysol would itself kill *Bacillus typhosus* in twenty-four hours, the question arose as to whether it was necessary to heat the vaccine at all before adding the lysol. A forty-eight hours' growth of typhoid bacilli in broth

was divided into two parts, one part was killed by heating to 53° C. for one hour and 0·25 per cent. of lysol was subsequently added; the other half was killed by the simple addition of 0·25 per cent.

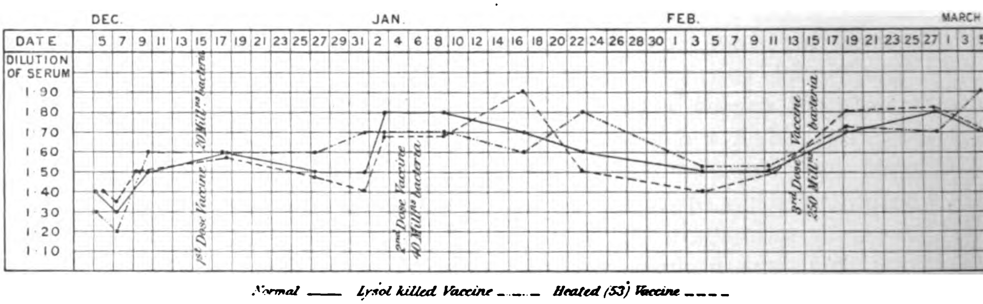

Chart I.—Bactericidal action of the sera of a group of rabbits inoculated with vaccine killed by heat at 53° C. for one hour, and subsequently mixed with 0·25 per cent. lysol, compared with the bactericidal action of the sera of a group of rabbits inoculated with a corresponding dose of vaccine killed by the simple addition of 0·25 per cent. lysol.

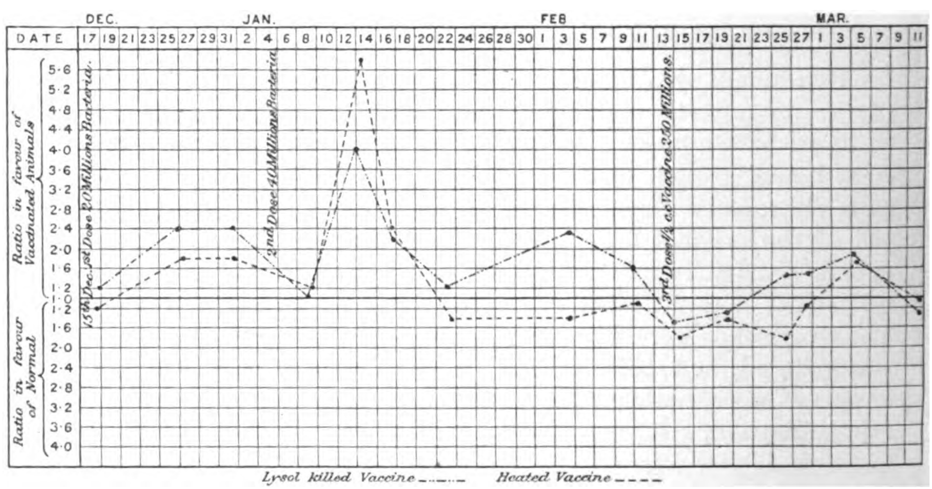

Chart II.—Phagocytic indices of a group of rabbits inoculated with vaccine killed by heat at 53° C. for one hour, and subsequently mixed with 0·25 per cent. lysol, compared with the phagocytic indices of a group of rabbits inoculated with a corresponding dose of vaccine killed by the simple addition of 0·25 per cent. lysol.

lysol, and was found to be sterile at the end of twenty-four hours. The vaccines were administered hypodermically to, in each case, three rabbits, the dose given being 43 million bacteria, and the subsequent observations were made on the "pooled" sera of the

three rabbits in each group, the pooled sera of three normal rabbits serving as a control. In the first experiment there was a rise in agglutinins, bactericidal substances, and in substances concerned with phagocytosis in the case of those rabbits which were inoculated with the vaccine killed by lysol only; but there was absolutely

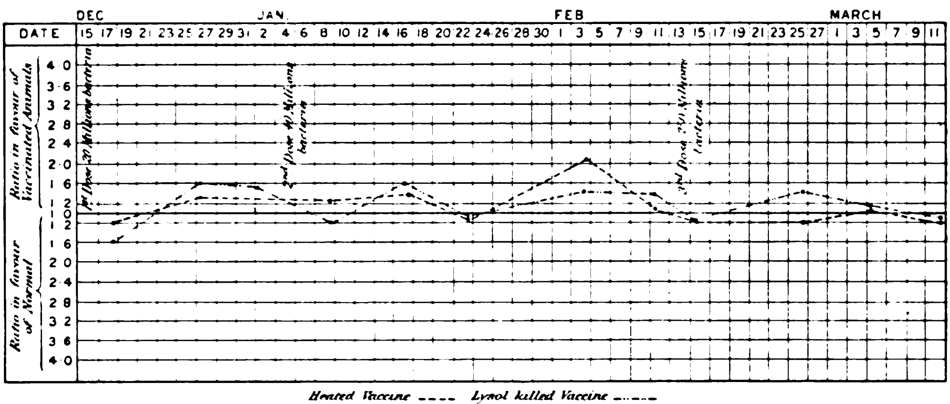

CHART III.—"Stimulin" chart of the sera of rabbits inoculated with (*a*) vaccine killed by heat at 53° C. and subsequently mixed with lysol (0·25 per cent.); (*b*) vaccine killed by 0·25 per cent. lysol only.

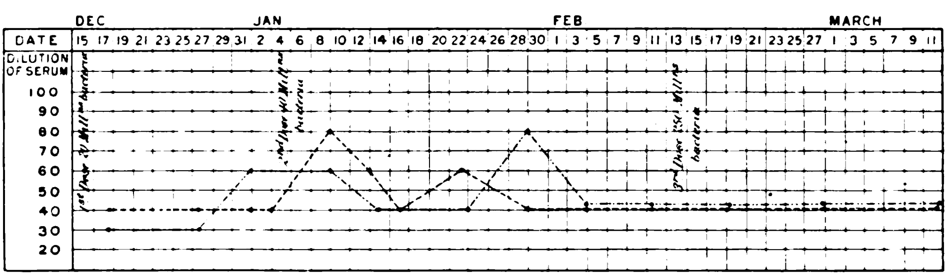

CHART IV.—Agglutinins produced in rabbits by inoculation of (*a*) vaccine killed by heat at 53° C. and subsequently mixed with lysol (0·25 per cent.); (*b*) vaccine killed by 0·25 per cent. lysol only.

no change in the case of those rabbits inoculated with the vaccine which had been killed by heat and subsequently mixed with lysol. This result was inconsistent with results previously obtained in rabbits by the use of a vaccine similarly prepared, and it was suspected that it might be due to the fact that the lysol had been

added before the heated vaccine had cooled down. As will be seen below, this suspicion was confirmed, and the accident has thus served to indicate a very necessary precaution in the practical preparation of anti-typhoid vaccines. The experiment was repeated, this time taking care to allow the heated vaccine to cool down before adding the lysol. It will be seen from the accompanying charts (Nos. I. to IV.) that there is no great difference in the effects of the two vaccines; so that it would appear, so far as this single experiment goes, that it is not necessary to heat the vaccine before adding the preservative, and, on the other hand, that heating to 53° C. does not appreciably impair its efficacy. It is necessary, however, to have further evidence on this point before one can abandon the present method of preparing the vaccine, which has been proved to give good results in actual practice.

The Effect of Swallowing Dead Typhoid Bacilli Suspended in Fat.

Emulsions of twenty-four-hours' cultures of *B. typhosus* were made in sterile water and then desiccated over sulphuric acid. The resulting mass was found to be sterile after forty-eight hours, and was then ground to a powder and mixed with lard, to which a little stearine had been added in order to make a firmer mass. The fat was used in order to protect the bacterial bodies from the action of the gastric juice, and it was hoped that they would subsequently be absorbed along with the fat particles from the small intestine. An experiment with a suspension of dead tubercle bacilli in fat had been previously made on a guinea-pig—the guinea-pig was killed three hours after swallowing the mixture and smears of its organs were made, a few tubercle bacilli were found in the mesenteric glands and the spleen. The mixture of typhoid bacilli and fat was divided into pills, each containing the bacteria from one agar tube of culture. These pills were swallowed at short intervals by one of us (W. S. H.) who had already been the subject of other experiments of a similar nature, and whose blood still showed evidence of the presence of substances antitropic to the typhoid bacillus. The pills were swallowed half an hour before breakfast in each case, at intervals of about two days, as shown in the charts (Nos. V. to VIII.); they caused no untoward symptoms with the exception of some slight nausea, at times, for an hour or so after swallowing them; this was attributed to the unpleasant flavour of the stearine. The results of the blood examinations

are shown in the accompanying charts; it will be seen that there is a general rise in agglutinins and in the substances concerned with phagocytosis, and that the bactericidal power of the serum was depressed at one time, but rose above normal on discontinuing the use of the pills.

Ingestion of Dead Typhoid Bacteria Suspended in Lard.

In this experiment (Nos. IX. to XI.) the subject (R. G. A.) had not been previously inoculated and the dried bacteria were suspended in lard only, the mixture being put into gelatine capsules, each containing the bacteria from one agar slope. In the preparation of the fat suspension it was found that, although one could not rely on the preliminary drying to kill the bacteria, they died within twenty-four hours after admixture with the lard. The capsules were swallowed at first at intervals of about one month, and, towards the end of the experiment, about every ten days. No agglutinins appeared at any time, which is in contrast with the results of the former experiment, and this seems to show that agglutinins are formed during such experiments only when the doses are repeated at short intervals. The bactericidal power of the serum was likewise not appreciably affected by the doses given. The power of the serum to encourage phagocytosis, however, was affected very distinctly by each dose; there was a rise in the phagocytic index thirteen days after taking the first capsule, and this rise was repeated after each dose, but at a shorter interval. There was a slight drop in phagocytosis on the fourth day after the third dose, and this was followed by a rise above normal on the tenth day. On the twenty-sixth day after the third dose the phagocytic ratio fell below normal. This may be attributable to the effect of a severe cold from which the subject of the experiment was suffering at the time. In the experiments of January 2nd and 14th the blood was taken six hours after swallowing a capsule, and it will be seen that, on both these occasions, the phagocytic ratio fell below normal for the time being. The "stimulin" chart follows very closely the line taken by the chart of the phagocytic ratio, a phenomenon which we have found to be very constant throughout our work; the figures for the construction of this "stimulin" chart are arrived at by a comparison of the phagocytosis in the following mixtures after exposure to 37° C. for fifteen minutes:—

A.

Washed blood-cells	3 volumes
Heated (60°) normal serum	2 ,,
Heated (60°) normal serum (diluted to 1—5) ..	1 volume
Emulsion of *B. typhosus*	1 ,,

B.

Washed blood-cells	3 volumes
Heated (60°) normal serum	2 ,,
Heated (60°) immune serum (diluted to 1—5) ..	1 volume
Emulsion of *B. typhosus*	1 ,,

In the estimation of the "phagocytic ratio" the control experiment has the same formula as (*a*) above, and in the test experiment the *whole* of the normal serum is replaced by an equivalent volume of serum from the immunised subject.

The Use of Washed Bacteria as a Vaccine.

The object of this experiment was to see if the local reaction could be reduced by giving the bodies of the dead bacteria, free from the fluid in which they had grown and in which they had been killed. A forty-eight-hours' broth culture of typhoid bacilli was killed by heating to 53° C. for one hour; it was then centrifuged and the resulting deposit was washed in normal saline, being finally taken up in such a quantity of 0·25 per cent. of lysol in normal saline as would make the emulsion up to the same strength as the original culture, viz., 500,000,000 bacteria per cubic centimetre.

A dose of 1 cc. of the emulsion was given to one of us (W. S. H.) by hypodermic inoculation into the abdominal wall; the result was as follows: Pain on movement came on three hours after inoculation; it was not severe, and the subject was able to take a long walk the same afternoon and to spend the evening gardening (not digging); rest was not disturbed at night, and there was no difficulty in turning about in bed; a walk of 4 miles was taken the following day without great discomfort. The tenderness was increased by taking a glass of beer, but it did not become severe. The whole of the local symptoms were gone at the end of thirty-six hours. General reaction consisted of slight fever and headache, not at all severe; appetite and capacity for work were unimpaired. Taking them altogether, the local and general reactions were much less severe than after a dose of standard vaccine taken by the same subject some two years previously.

Several volunteers (officers on probation) were subsequently inoculated in the abdominal wall with the suspension of washed typhoid bacteria. Their reports were as follows:—

(*a*) "Continuous 'stitch' for eight hours: general symptoms very slight."

(*b*) "Tenderness at the site of inoculation and headache were the only symptoms."

(*c*) "Very slight local symptoms ; felt very well."

(*d*) "Moderate local reaction, felt feverish eight hours afterwards, later well."

(*e*) "Pain bad same night ; bad only on movement the following day, no sleep the first night."

(*f*) "Mild local reaction ; felt a little seedy, nothing more."

(*g*) "Very mild local reaction; could get about ; general symptoms very slight."

(*h*) "Moderately severe local reaction, but could get about; general symptoms very slight."

(*i*) "Very severe local reaction same evening ; it lasted for one and a half hours and then disappeared. Slight faintness the same evening, quite well next day."

A number of other lieutenants on probation were inoculated at the same time with a corresponding dose of ordinary vaccine, and a comparison of the effects in the two cases gave one the impression that the local symptoms were milder after the use of the washed bacterial vaccine than after the injection of the ordinary vaccine.

All those who had received the washed bacterial vaccine on the first occasion received a dose of ordinary vaccine after an interval of ten days, and their symptoms were, taking them altogether, more severe than on the first occasion, and more severe also than in the case of those inoculated for the second time who had had the standard vaccine for their first dose. Whether this was because the first dose did not protect sufficiently, or whether their reports were biassed by the comparison with their first experience, it is difficult to say.

Comparative estimations of the anti-tropic substances produced in the blood of those receiving washed bacterial vaccine and those who had been inoculated with standard vaccine showed no great differences except in the matter of agglutinins, which were very much lower in the case of those who had been inoculated with the washed bacterial vaccine (1—80 as compared with 1—800). A very much simpler way of reducing the discomfort due to the local symptoms has been found to be to change the site of inoculation to the infra-clavicular region, or to the outer side of the arm at the level of the insertion of the deltoid muscle. Either of those sites

has been found to present such advantages over the abdominal site that we now recommend them for general use. It is necessary to make certain that the needle enters the subcutaneous tissue, for if the inoculation be made in the deeper layers of the derma, the pain

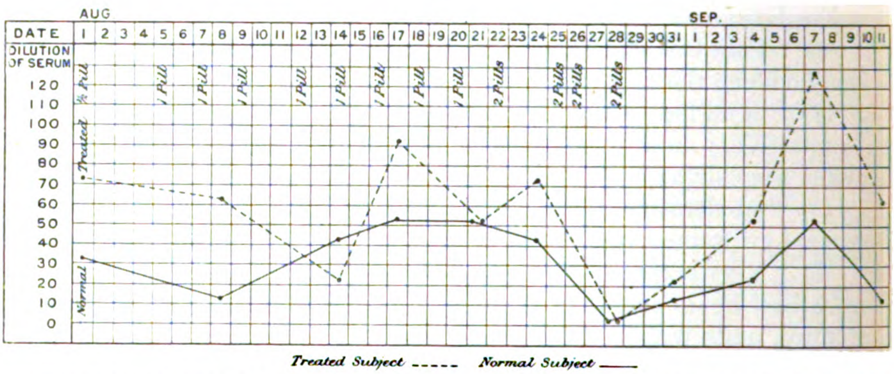

CHART V.—Showing the bactericidal action of the serum of a subject (W. S. H.) after swallowing a suspension of dead typhoid bacilli in fat.

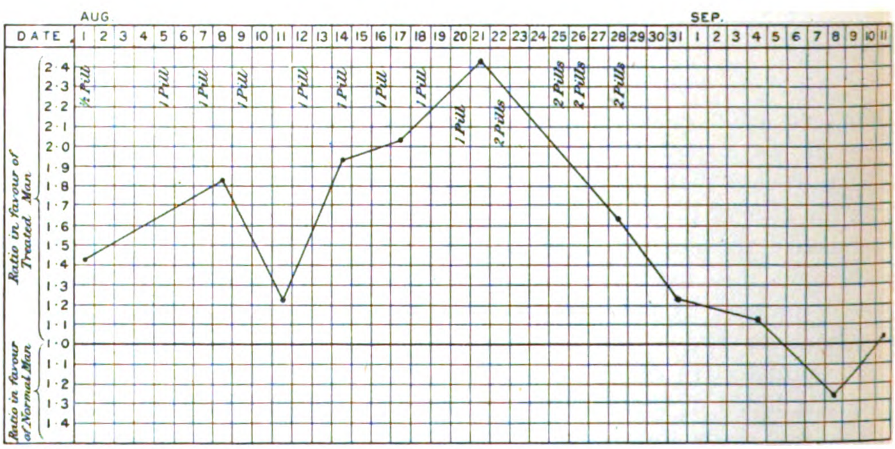

CHART VI.—Showing the phagocytic ratio of the serum of a subject (W. S. H.) after swallowing a suspension of dead typhoid bacilli in fat.

at the time of the operation is considerable and the local reaction is apt to be much more severe, a result which was noted by one of us who received, accidentally, a very small dose of vaccine into the derma instead of into the subcutaneous tissue. It was noted at the

time of the operation that this was happening, there being considerable smarting and the skin becoming puckered and bleached, but the operation was continued in order to see the effect. Another of us received a full dose of standard vaccine intra-muscularly, and in this case also the local reaction was abnormally severe.

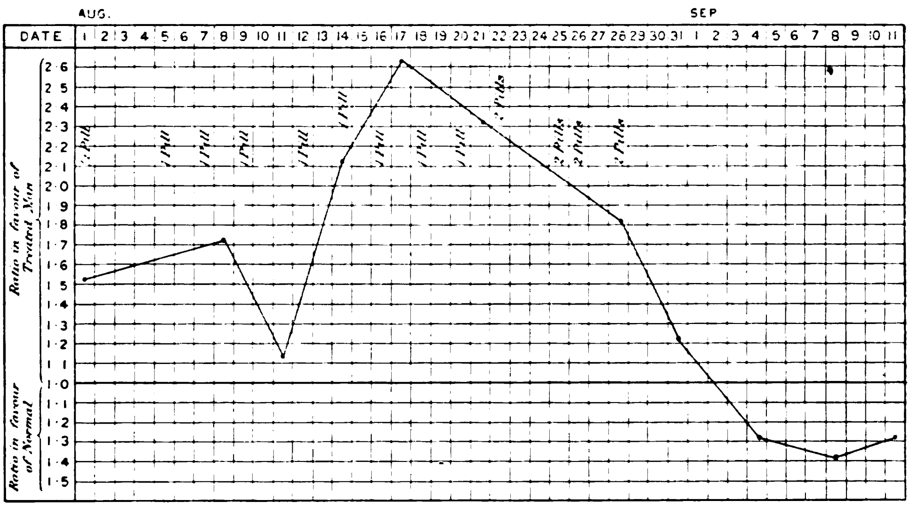

CHART VII.—Showing the "stimulin" action of the serum of a subject (W. S. H.) after swallowing a suspension of dead typhoid bacilli in fat.

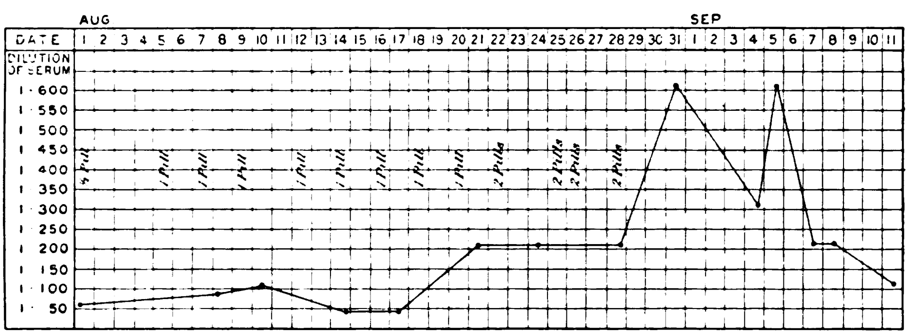

CHART VIII. — Showing the agglutinins in the serum of a subject (W. S. H.) after swallowing a suspension of dead typhoid bacilli in fat.

The Use of Vaccine Killed by Glycerine.

As previously reported,[1] it had been found that the addition of 20 per cent. of neutral glycerine to a culture of *B. typhosus* was

[1] Harrison, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, May, 1907.

sufficient to kill it in about four days when the mixture was kept at blood heat. The culture, when killed, gradually loses the opaque appearance of a well-grown broth culture of typhoid bacteria and eventually becomes almost as transparent as the original broth. From microscopic examination of the resulting fluid it seems probable that this change in appearance is due to a solution of the greater portion of the organisms, though a few, roughly about a tenth of the original number, remain unaltered in appearance. As this was the nearest approach to a complete solution of the bacteria in a culture that we had hitherto obtained, and as the preparation of a vaccine by this method would be extremely simple, it became of interest to find out whether the fluid so prepared possessed any value, and if so how much value, as a vaccine.

Two vaccines were prepared, *A* and *B*. *Vaccine A* was made by adding 20 per cent. of glycerine to a twenty-four-hours' broth culture of a strain of non-virulent *B. typhosus* ("R") which has been largely employed in the preparation of vaccine for the troops. The mixture was kept at 37° C. for a week, when it was found to be sterile. The original culture contained 503,000,000 bacteria per cubic centimetre. *Vaccine B* was prepared in the same way as vaccine A, but was made from a culture of a virulent strain ("L") of *B. typhosus*. The original culture contained 475,000,000 bacteria per cc.

Two groups of rabbits were inoculated, one with vaccine A, the other with vaccine B, the doses being $\frac{1}{25}$ cc. on December 31st, 1906, $\frac{1}{12}$ cc. on January 16th, 1907, and $\frac{1}{6}$ cc. on February 2nd, 1907. The estimations of anti-tropic substances were made from the pooled sera of each group of rabbits, and the control was, in each case, the pooled sera of a similar group of normal rabbits. The test organism was of the non-virulent strain ("R") from which the vaccine A had been prepared. Agglutinins appeared to only a slight extent, the highest point reached being 1—60 in the case of the vaccine B rabbits, and this on one occasion only. (Charts Nos. XII. to XIV.) showing the bactericidal action of the sera of the experimental animals and the results of the phagocytosis experiments are appended. It seems clear from these that a vaccine prepared in this way is effective, and, further, that such a vaccine prepared from a virulent culture appears in some respects more effective than the one prepared from a non-virulent culture. In this connection it is to be noted that the test organism for the experiments was of the same strain as that from which the vaccine A (non-virulent strain) was prepared. Further experiments are

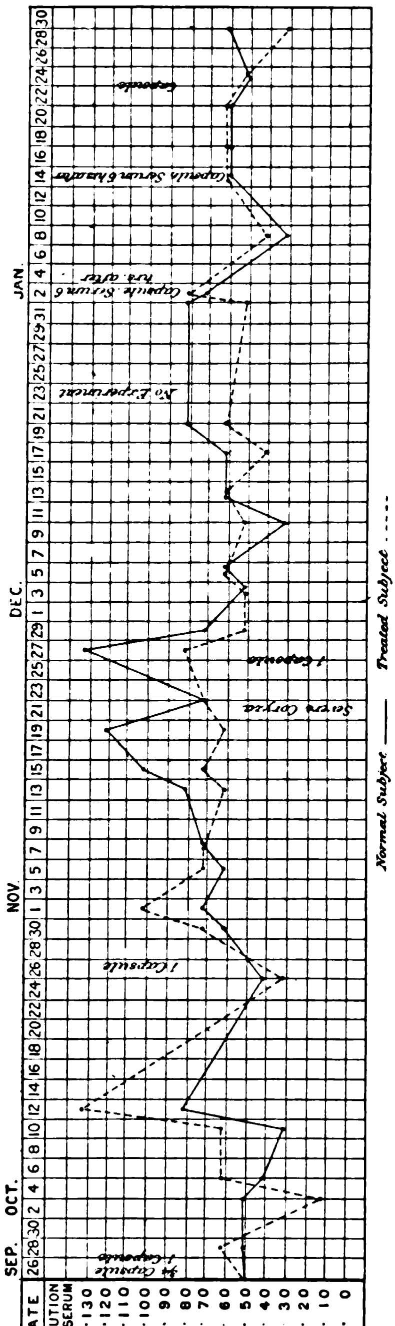

CHART IX.—Showing the bactericidal action of the serum of a subject (R. G. A.) after swallowing suspension of typhoid bacilli in lard.

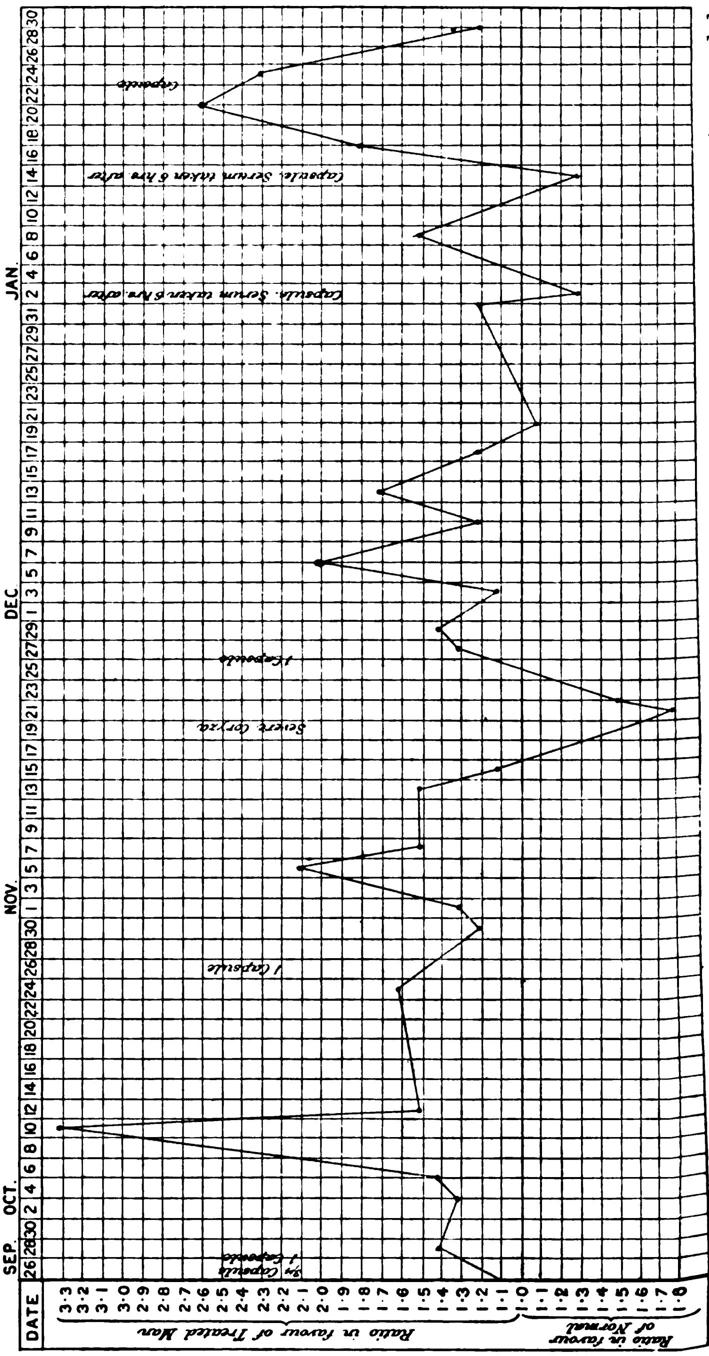

CHART X.—Showing the phagocytic ratio of the serum of a subject (R. G. A.) after swallowing dead typhoid bacteria suspended in lard.

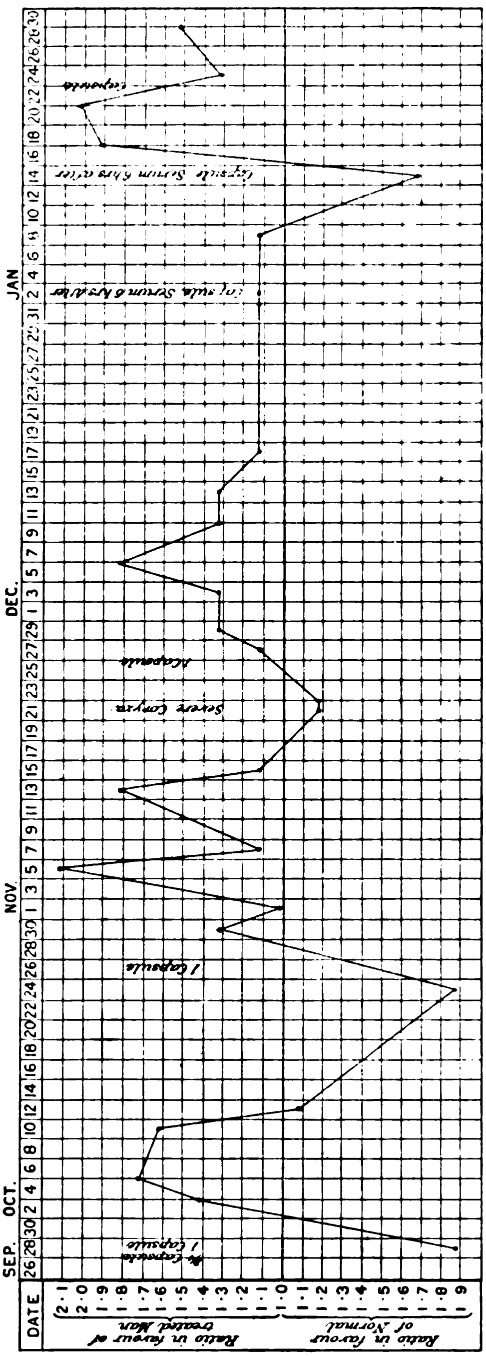

CHART XI.—Showing the "stimulin" action of the serum of a subject (R. G. A.) after swallowing dead typhoid bacteria suspended in lard.

in progress to find out how far these results apply to man, and whether this method of preparing a vaccine presents any practical advantages over that at present in use.

The Immediate Effect of the Second Inoculation on the Development of Protective Substances.

Twelve officers, who had received their first inoculation at the same time, were divided into two groups of six each; one group was re-inoculated at the usual time, and in the other group the re-inoculation was postponed for a day or two and comparative observations were made on the pooled sera of the members of each group. It

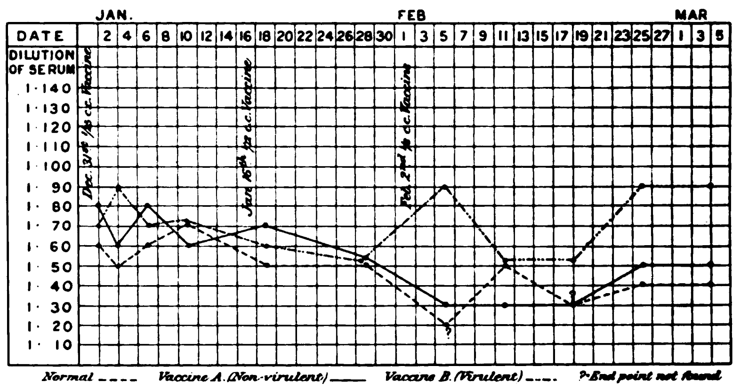

CHART XII.—Bactericidal action of the sera of (1) two normal rabbits; (2) two rabbits vaccinated with *B. typhosus* ("R"), non-virulent, killed by glycerine (20 per cent.), for one week, at 37° C. = Vaccine A; (3) two rabbits vaccinated with *B. typhosus* ("L"), virulent, killed by glycerine (20 per cent.), for one week, at 37° C. = Vaccine B.

was found that, on the two days following re-inoculation, the bactericidal power of the serum of those who had been reinoculated was a point lower (1—60 as compared with 1—70) than in the case of those who had, up to that time, only received one dose of vaccine, but it did not fall to normal (1—40). Agglutinins were reduced from 1—800 to 1—500 on the day following re-inoculation, but they had already recovered on the second day, and were then higher than in the case of those men who had only received one dose of vaccine (1—1,500 as compared with 1—1,000). The phagocytic index was markedly lowered, as a result of the second dose, but it was, unfortunately, impossible, owing to the exigencies

of the Service, to continue these observations beyond the second day after inoculation.

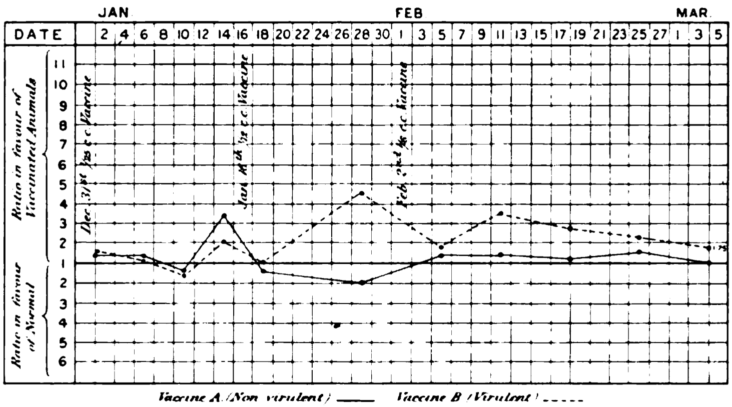

CHART XIII.—Phagocytic ratio of the sera of two normal rabbits, and (A) two rabbits vaccinated with *B. typhosus* ("R"), non-virulent, killed by glycerine = Vaccine A; (B) two rabbits vaccinated with *B. typhosus* ("L"), virulent, killed by glycerine = Vaccine B.

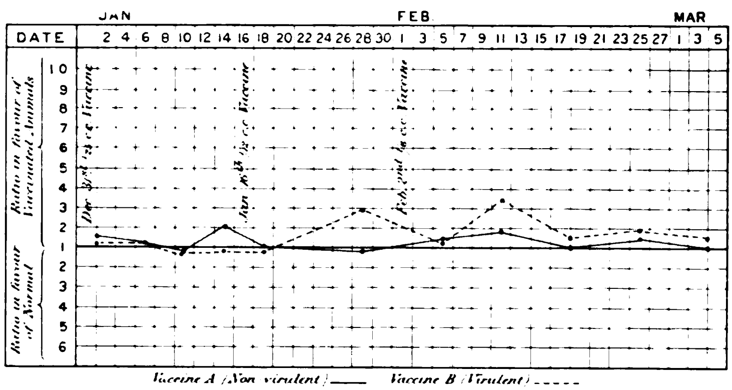

CHART XIV.—Effect of substituting 1 vol. of serum of vaccinated rabbits (diluted 1—5) for 1 vol. of similarly diluted normal serum in the following mixture: Washed cells = 3 vols.; normal serum = 2 vols.; normal serum (1—5) = 1 vol.; emulsion B.T.A. = 1 vol. Vaccine A = B.T.A. ("R."), non-virulent, killed by glycerine; Vaccine B = B.T.A. ("L."), virulent, killed by glycerine.

ACTION OF THE SERUM UPON PARATYPHOID BACILLI AFTER TYPHOID INOCULATION.

This appears to be a point of considerable practical importance, in view of the fact that a certain number of cases of supposed

typhoid fever occurring in inoculated men have been proved to be paratyphoid by the isolation of this germ from the blood-stream.

For the purpose of the experiment the blood of two men, who had previously been inoculated against typhoid, was tested as to its agglutinative, bactericidal and phagocytic power against paratyphoid "A" and paratyphoid "B" respectively.

(1) *Paratyphoid* "A." *Bactericidal Estimation.*—The serum of an inoculated man, "H.," was found to kill this strain of paratyphoid in a dilution of 1—50, while the control serum, derived from a non-inoculated man, only killed in a dilution of 1—30. On repeating this experiment, however, on another occasion, no difference was found, both the normal and the immune serum killing in a dilution of 1—20. The technique was that employed for the estimation of the bactericidal substances throughout the former experiments.

Agglutinins.—A slight "group agglutination" was found on the two occasions on which this was investigated, the same figure being recorded in each instance, viz., incomplete clumping of the paratyphoid bacilli in half an hour in a maximum dilution of 1—30. The control normal serum showed no trace of agglutination in the same time in a dilution of 1—10.

Phagocytosis.—The phagocytic ratio of "H.," tested on two occasions, was found to be 1·6 on the first investigation and 1·2 on the second. A similar experiment on the serum of a second inoculated man, "E," whose ratio to the typhoid bacillus was at the moment 2, showed, when tested against the paratyphoid "A," a ratio of 1·1.

(2) *Paratyphoid* "B."—Similar experiments were made with the same serum against this strain and with much the same results. In the case of the bactericidal substances the serum of "H." on one occasion killed the paratyphoid bacilli in a dilution of 1—10, while the normal serum failed to kill in this degree of concentration. On a subsequent estimation both "H's." serum and that of the control failed to kill in this dilution. Agglutination was incomplete in a dilution of 1—30, and the phagocytic ratio was found to be 1·1 against this strain on comparison with that of a non-inoculated control.

It would appear, then, as far as may be concluded from these few experiments, that inoculation with anti-typhoid vaccine does *not* confer any marked immunity against infection by paratyphoid bacilli, as judged by the development of protective substances in the blood.

Action of the Serum after Typhoid Inoculation upon Strains of *B. typhosus* other than that employed for Immunisation.

The serum used was that of "H.," who had been inoculated with vaccine prepared from the strain "R," and who, on a subsequent occasion, had ingested pills and capsules containing dead typhoid bacilli of the same strain.

The bactericidal action of "H.'s" serum was determined against the strain "R," with which he had been immunised, against strain "G," of equally low virulence, and against a third strain, "B," of moderate virulence for guinea-pigs. The technique employed was to mix together one volume of the serum, diluted in varying degrees, with one volume of a twenty-four-hours' broth culture of each of these three strains of typhoid, diluted with sterile broth to 1—10,000. After incubation of the mixtures for one hour at 37° C., they were blown out into test tubes of McConkey's mannite bile-salt medium, which were then incubated for twenty-four hours.

The results are shown in the following table, and it will be seen that, in each case, there is practically the same difference in favour of the immune serum, as compared with the bactericidal action of the serum of the normal individual used as a control. This result is in confirmation of similar experiments which had been made at an earlier date, and points to the conclusion that a monovalent vaccine may be relied upon to induce the formation of protective substances which are effective not only against the a-virulent strain employed as a vaccine, but also against the other and more virulent strains of *B. typhosus*.

	Dilution of sera													
	50	60	70	80	90	100	110	120	130	140	150	160	170	
Normal ..	–	–	–	–	–	–	–	+	+	+	+	+	+	"R"
Immune (H)	–	–	–	–	–	–	–	–	+	–	+	+	+	strain.
Normal ..	–	+[1]	–	–	+	+	+	+	+	+	+	+	+	"G"
Immune (H)	–	–	–	–	–	–	+	+	+	+	+	+	+	strain.
Normal ..	+	+	+	+	+	+	+	+	+	+	+	+	+	"B"
Immune (H)	–	–	+	+	+	+	+	+	+	+	+	+	+	strain.

+ = Growth. – = Sterile. [1] Experimental error.

SOME OBSERVATIONS ON BLACKWATER FEVER.

By Captain D. S. SKELTON.
Royal Army Medical Corps.

"The intensity of malaria displays itself in blackwater fever."—Axiom: Dr. J. W. W. Stephens.

It is with the utmost diffidence that I venture to offer any remarks on a subject that has engaged the earnest attention of medical men. At the same time, I plead that blackwater fever is a disease, or a complication of a disease according to the school of thought to which the individual observer may belong), whose etiology and even treatment are matters for marked differences of opinion; so much so, that an important School of Tropical Medicine is, at the moment of writing, about to send out a Commission to investigate, in the hope that their researches may throw some light and meaning on a page in the book of tropical medicine which at present is so vague as to be almost valueless. Under these circumstances, even in times of the most acute mental depression, one hopes that in a small mass of clinical evidence some point may be found that will add something to the general knowledge on the subject.

In my preliminary observations it is hardly necessary to note that blackwater fever is a disease that seldom comes under the notice of the general run of Royal Army Medical Corps officers. I cannot help thinking, however, that, once met with, the fascination inspired by this fell complaint is all-compelling. The suddenness (in many cases) of its onset, the almost secrecy of its ways, the apparent impossibility of guarding against it, *must* cause the tropical clinician to give it his closest attention and interest.

One feels that here

> "The ball no question makes of Ayes and Noes,
> But here and there, as strikes the player, goes."

It makes one think of cholera in the old dark days when vibrios did not wriggle and bacilli were unknown. I must also ask to be excused for reminding readers of some general points about this disease.

Definition.

Blackwater fever is not a very difficult disease to define. It is an acute hæmolysis, generally sudden in its onset, characterised

by pyrexia, persistent and distressing vomiting, marked jaundice, and the passage, usually in diminishing quantity, of black or brown urine.

History.

Manson says it was first described by a naval surgeon at Nossi Bé. Plehn asserts that it first began to be common in West Africa about 1850; but the first recorded death took place in 1832. Fisch, on the Gold Coast, is inclined to think that it is more common nowadays, though less virulent, or, rather, fatal, than it was thirty years ago. He points out that whereas the fatality was formerly always very high, it now averages only about 20 per cent. Certainly our own admission and discharge books show a higher frequency to-day than formerly. This may be more relative than absolute. We may flatter ourselves that nowadays our diagnoses are more accurate, or that our attention is more directed towards blackwater fever; or even, according to some, that owing to a proper appreciation of things, the habit of taking quinine is more general than it used to be! It may also be added that blackwater, as such, and as a separate entity, does not appear in the Nomenclature of Diseases. We enter it as "remittent" or "malarial fever" (blackwater).

Etiology.

Geographical Distribution.—In Europe it occurs sporadically, so to speak. It has been met with in Italy and Sicily, Greece and Spain, or, rather, it has been reported from these places. It has been found in Asia Minor and in Syria. In India it occurs in comparatively few places, viz., in the Terai, in the Duars, in Jeypore (Madras), in the Canara district (Bombay), in some parts of Assam and in Upper Burmah. In parenthesis, it may be remarked that all these are notoriously malarial spots. It is found in the Malay Archipelago, especially in Java and Sumatra. It is Africa, however, that seems to be the "place of election"; and it is with blackwater, as found on the African littoral, that I am concerned with in these notes. Broadly speaking, where malarial fevers have their highest "endemic index" there is blackwater. That is to say, on the West African Coast, and up the West African rivers, from 20° N. to 20° S., roughly, from Bathurst to Lobite Bay. On the East Coast, it is found through Portuguese East Africa, and in Zanzibar. It is found in Madagascar and in Nossi Bé. Cases

have been reported from Somaliland, and Captain Ensor, D.S.O., R.A.M.C., reported in this Journal a series of cases he had met with in the Bahr-el-Ghazel. It is common in British Central Africa, around Blantyre, and the Great Lakes. It occurs in some of the Southern States of North America, in Central America, and in certain places in South America, notably in Brazil. It is found in certain of the West Indian Islands. It breaks out occasionally on board ship coming from endemic areas.

Connection with Malaria.—That it has a close connection with malaria is a point upon which all who have met with the disease are agreed. Whether malaria, that is one single attack or a series of attacks, can *per se* bring about an attack of blackwater is a point upon which the future must come to some decision. Consequently, it is safer at the present time to enter malaria as a predisposing, rather than as an exciting cause. All, therefore, that can be said is that intense malaria is associated with the presence of blackwater. But tropical medicine is becoming day by day less empirical, and the man who, without absolutely *knowing*, states anything, is very likely to be called on almost the very next day to explain. In support of this, I would remind my readers of the views about kala-azar that were held only a few years ago, when some of the men—great authorities they were—made absolute statements about it; they must be sorry now they were ever persuaded to speak at all. At the same time, no one can contradict Stephens, when I requote his aphorism: "The intensity of malaria displays itself in blackwater fever." Further, this authority says: "It can only occur in those who are suffering from, or have been recently infected with, malaria." I have not been able to find, in the literature I have availed myself of, any record of a case without the patient having given a history of at least one attack of malaria. Sometimes, as in two or three of my own cases, the attack has been so slight as to hardly make it worth the while of the patient to stop his daily work. In thus speaking of the relation of blackwater and malaria, one comes to the question of residence in malarial countries, and immunity.

Residence.—Blackwater rarely shows itself before at least six months have been spent under malarial conditions, and the longer one is exposed to malaria, and the longer one escapes having, at any rate, severe attacks, the less likely would it appear that one will contract blackwater. That this is a working rule is evidenced by the table given in Stephens' latest work, which he quotes from Beranger-Féraud, who gives the following statistics:—

First year	5·4 per cent.
Second year	22·5 ,,
Third year..	42·5 ,,
Fourth year	20·0 ,,
Fifth year	4·8 ,,

The interpretation is, that either it is a case of the survival of the fittest, or that residence confers some degree of immunity. The notorious exceptions are, amongst others, the case recorded by Daniels, of a man who spent eleven years in British Central Africa and then contracted blackwater; and even this does not hold the record, for a case was reported in the *British Medical Journal* of a man who contracted the disease after no less than twenty years residence in malarial Africa.

Immunity.—The immunity, then, if any, is only relative. At the same time, it is a generally agreed upon fact on the West Coast that one does acquire some sort of immunity to malarial fever after a certain period of residence, and the figures of Beranger-Féraud seem to me to bear out this tradition; and there is this fact to take into consideration, that there are a great many men who come out to the Coast and do tour after tour, take no quinine, and complete their tours without getting any fever at all. Given, then, some sort of immunity against malaria, it is only reasonable to suppose that these immune persons are less likely to contract blackwater than the relatively new-comers.

Endemicity.—There seem to be certain spots in the blackwater countries where one can contract blackwater more readily than others. In Sierra Leone I have been struck by this fact. At Murree Town, about three miles out towards the promontory, a detachment of sappers were stationed to work the search-lights. It is a place that one would have put down as being fairly safe, as it is on the seashore, and fairly well removed from native dwellings; all round, the bush had also been fairly well cleared; yet in my series of cases all the Royal Engineer cases had been stationed at Murree Town. No Europeans are allowed to live there now, and what was then almost an epidemic appears to have entirely stopped since they were moved away. It may be added that these men took their quinine regularly and used their mosquito nets, but the nature of their work compelled them, and still compels them, to do their work at night at least once a week.

Sex is not supposed to have any influence. In my series of cases there are two women, with one death. For a medical officer in charge of not more than fifty women, this is a high incidence; and to judge

by the way the last case succumbed, I do not put much faith in their powers of resistance. I have not yet met with a case in a child, although my duties give me abundant opportunities for observation. Children harbour the malarial parasite without showing signs of the disease. Whether they can do the same in blackwater I do not know; it is possible.

Susceptibility.—In West Africa, as would be expected, Europeans are the most susceptible, next come the West Indians of mixed blood, then West Indian negroes, and at the bottom of the scale the West African native. Observers on the East Coast note that Arabs, Eurasians and natives all suffer. It is the same in the case of Chinese and Malays, but to all practical purposes the pure "Bush boy" is immune. Plehn has observed an individual susceptibility. I myself have known an officer in the Preventive Service of the new Northern Territories who is alleged to have had eight attacks, and I have a West Indian orderly who is just entering on his third: but blackwater is said to be milder as attacks recur.

Seasonable Prevalence.—Blackwater should present some relation to the malarial curve, and indeed, I find that it does; for I note during the past few years that the greatest number of cases occur in July and August, whereas the highest malarial ratio is in July. These months, it may be noted, are also the coldest months of the year, and consequently those in which a paludic is more likely to take a chill.

Incidental Causes.—The only incidental cause I feel disposed to admit of is change of climate, which again is possibly a question of "catching a chill," already alluded to above. I consider it to be a real danger to send a patient home who is just getting over the last of a series of attacks of malaria. The homeward voyage from the Coast is very different to the one homeward from India. Cape Blanco on the West African Coast has an evil reputation in this respect. One meets here the full force of the cold north-east trade winds, then, given some previous fever, your patient develops a "chill on the kidneys," and the ship slows down to drop him overboard. Thus Africa, who is difficult to rob of her children, claims her own. Hasty invaliding for malarial fever is worse than panic.

Summing up, then, the various etiological factors, one finds one's self, amongst other things, face to face with the fact that, in spite of the malarial world being so large, the distribution of blackwater is, after all, very small and very local. Why does one only find it in certain parts of the malarial world? I have wondered myself why I got so many cases from Murree Town. One explanation

commonly given is that the distribution corresponds more especially with the distribution of the malignant tertian type of malaria. It is suggested that the parasite found in paludics in India is usually the benign tertian. This, however, hardly holds good if one goes about the world with a microscope. Personally, I have met malignant tertian in other parts of the world besides the West Coast, and in places, too, where there seemed to be just the same other etiological factors. For instance, I may mention the Mutwal district near Colombo, and the dense jungle country in the Eastern Province of Ceylon; in both these districts the type of malarial fever was the same malignant tertian variety that I meet with in Sierra Leone; yet in two years in Ceylon I never saw a case of blackwater fever or heard of one. It was the same at Koomati Poort, the same pernicious variety of malaria, but no blackwater. It seems, therefore, that one must fall back on some other actual determining factor, and herein lies the real fascination of the disease. And so one is obliged to look to "authority," and I must therefore recall some of the opinions and theories of the various experts.

Koch, in 1898, went out to the Kamerun, and, as the result of his investigations, came to the conclusion that the necessary formula was: malaria + quinine = blackwater. Then Koch and Tomaselli both quoted cases where the taking of quinine was actually followed by an attack of blackwater. These are classical instances. The news that quinine caused blackwater spread amongst laymen like wildfire, and, it must be admitted, has done a large amount of harm. One seeks for almost any excuse to avoid taking quinine, and a misunderstanding on the part of laymen on the teaching of the "quinine school" gave the very excuse which new- and old-comers were alike looking for.

In 1900, Stephens and Christophers came to the conclusions: (*a*) That blackwater fever was malarial in origin; (*b*) that quinine in the great majority of cases was the proximate cause; (*c*) that there was no evidence of any special parasite.

Daniels, writing some years ago, noted that blackwater occurred in people taking quinine, but that it also occurred independently.

Crosse, who, be it said, has probably seen as much blackwater as any man, says: "I have not come across a single case in which people who have taken quinine regularly as a prophylactic have been attacked with blackwater." This is an opinion which I am afraid only a few medical men can endorse to-day; but all the same, the point may lie in the fact that those people who do contract

blackwater after religiously taking quinine as a prophylactic, have either not taken enough or else too much. Besides, no one can positively say that quinine will entirely prevent malaria, hence it is not an absolute prophylactic against blackwater.

H. Ziemann, in a long article, has recently reviewed the various theories; he asks, finally: Is blackwater (*a*) a disease *sui generis?* (*b*) a grave form of paludism? (*c*) or a simple quinine intoxication? And he comes to the conclusion that there seem to be two main causes: (1) A predisposition, resulting from former paludism, especially if no quinine has been taken; and (2) excessive treatment for malaria itself.

F. Plehn records twenty-four cases out of forty, where blackwater broke out after the administration of quinine, and A. Plehn gives forty-eight out of fifty-five, which he considers were directly attributable to quinine.

Quennac, in the Sudan, saw only one case of blackwater end fatally, and that in a doctor, who habitually took no quinine.

Scheube, in his "Diseases of Warm Climates," though somewhat out of date now, reviews the matter, and thinks that the demand on the blood-forming organs in consequence of repeated attacks of malaria is excessive. A new invasion of parasites occurs, and a wholesale destruction of the red blood corpuscles follows, and thus blackwater originates. The hæmoglobin is partly carried to the liver, and there converted into bile pigment, and then partly excreted in the urine. In spite of the extraordinary figures originating from the Kamerum, this explanation certainly seems to accord with the ordinary clinical observations.

B. F. de Costa (St. Thomé) treats his cases by hypodermic injections of quinine in moderate doses and maintains that quinine is not the cause; while Ensor, in reviewing his series of cases, naively ascribes his only losing a small percentage of them to his refraining from giving them any quinine at all.

Plehn has suggested that some kidney lesion exists on top of the paludism, and his view is also suggested in a leading article in the *Indian Medical Gazette* for June, 1907. No doubt this view obtains credence from the fact that, coupled with the hæmoglobinuria, there is in almost every case a certain amount of albuminuria. I have never found any albumin in the urine, and what amount there is always clears up very quickly. None of my cases have ever been discharged from hospital as long as any albumin can be found in the urine. And it is surprising how soon this transitory

albuminuria clears up. This fact, on the face of it, does not look as if there were any primary kidney lesion.[1]

Finally, the quinine school gets its mandate from Dr. J. J. W. Stephens, who says: "The etiology of blackwater fever may be summed up by saying that it is malarial in nature, that is, it can only occur in those who are suffering from, or have been recently affected with, malaria, and that the onset of blackwater is induced most commonly, though not invariably, by quinine.

In this edict there is not much theorising. It is for all practical purposes plain fact. Let it then be reiterated: (1) All who are familiar with blackwater admit the occurrence of previous paludism; (2) all now agree that individuals do exist who develop hæmoglobinuria after taking quinine even in very small quantities; but (3) far from all agree that *the* most common cause of blackwater is quinine intoxication.

I came out to the Coast with opinions neither orthodox nor heterodox on this matter, but since I have had several cases of blackwater under my own care, and have had the opportunity of seeing other people's cases, I frankly confess I have come to consider the "quinine school" as the heterodox one. It seems to me that if one single case can be produced in which blackwater has occurred where quinine can be absolutely excluded (and these cases are well known and constantly met with), then the case for quinine as a proximate cause is considerably weakened. The converse, though, I cannot hold to be so true; since the relation between any drug's action and personal idiosyncrasy, is, as far as intoxication is concerned, and in our present state of knowledge, too uncertain a factor to be produced in argument.

Again, from figures worked out by Plehn, and quoted by Stephens, in connection with the incidence of the disease in quinine-takers and non-quinine-takers, I find the following:—

Quinine-takers.		*Non-quinine-takers.*	
Attacks of malaria ..	.. 90	Attacks of malaria ..	.. 287
Attacks of blackwater ..	.. 6	Attacks of blackwater	.. 31
Deaths from blackwater	.. 0	Deaths from blackwater	.. 10 %

To me it seems an extraordinary thing that the same drug acts in the one case as a partial protective, and in the other as a

[1] On the other hand, it must not be forgotten that malarial nephritis is by no means uncommon, though these cases bear no clinical resemblance to classical blackwater.

proximate cause. Further, it seems only likely, that if one treats an effect with a cause, except in the case of opsonic enthusiasts, the effect ought to be increased. Acting on my convictions, I have, as I shall show later, treated many of my cases with quinine, and with quinine in very large doses, with a view not to increase the effect, but to remove a cause by the specific action of quinine. I am quite prepared to admit that there are some people who are unable to take quinine without exhibiting the toxic effects of the drug. But these are people who, if they survive an attack of blackwater; should be invalided home and not allowed to come out again to any place that is malarial, or where they must take quinine to keep alive or in health.

I have noticed, too, amongst what I hope I may be pardoned for calling the rank and file of West African medical men, a majority in favour of quinine not being the exciting cause of blackwater; but when great "authorities," such as those I have already quoted, disagree, what then is the general practitioner to do? Imagine, he is away on some frontier, and his only white companion is down with blackwater, whilst the leading lights, sitting at home in professorial chairs, wrangle as to whether or not he is to give quinine to his dying patient.[1] The situation is ridiculous and unworthy of modern medicine. An unfortunate point about the whole controversy is that so much is decided at home by "authority," and no one in the face of such authority cares for the responsibility of looking out for himself. One thus comes to the rather sad conclusion that, as far as blackwater is concerned, we know practically no more about it now than was known in 1898, when Dr. Crosse wrote his celebrated article on it in the *Transactions of the Epidemiological Society of London*.

No account of the various views held by authorities as to the proximate cause of blackwater would be complete without calling attention to the results that are known to occur after infection by various species of piroplasma. It will be remembered that the piroplasmata are probably closely related to the malarial parasite. They are generally placed in the class of Hæmosporida, which includes, of course, Plasmodia, Halteridia, Hæmogregarina, and the Piroplasmata. Piroplasmosis occurs in all sorts of animals, and the leading symptom in all its forms is hæmoglobinuria. In

[1] Sir Patrick Manson's latest dictum appears to be: "Do not give quinine unless evidence of malaria exists." But that would only be in about 5 per cent. of cases.

dogs it is popularly called malignant jaundice. At the time of writing it is not generally agreed upon that there is a *Piroplasma hominis*, doubt having been thrown upon the piroplasmic origin of the spotted fever of the Rocky Mountains.

It may also be noted that certain forms of piroplasmata under the microscope look almost exactly like the parasites of malignant tertian fever. The tick is the intermediate host of the piroplasma. But the tick does not infect any other animal directly; an infected tick gives rise to an infected progeny, so it is the next generation that is infective.

Before finishing with the etiology of blackwater, I may as well record here my own personal views on the subject. In my own mind, I see two conditions :—

(1) Hæmoglobinuric paludism, which is what I personally mean when I speak of blackwater fever; (2) a quinine intoxication, supervening in many cases of paludism, which is what I personally do not understand by blackwater fever; and I am quite prepared to find that what *I* mean by blackwater fever will one day be found to be a disease *sui generis*, but a disease to which only paludics are susceptible.

Symptoms.

The classical symptoms are hæmoglobinuria, jaundice, pyrexia and vomiting. I do not remember to have seen any one symptom without the other three in any case of blackwater, no matter how slight.

Hæmoglobinuria is very often the first symptom that calls the patient's attention to his condition. In colour the urine is in the great majority of cases almost exactly the colour of stout. Occasionally it is more reddish. Albumin is always present in small quantities. The hæmoglobin is present in the form of methæmoglobin. It may be recognised with the spectroscope. Blood cells are not usually present.

Jaundice is generally very deep. In spite of this, however, I have not met with a case where complaint was made of the itching, which is so troublesome in ordinary jaundice. I am inclined to think, however, that it does slow the pulse, as sometimes the pulse-count is out of all proportion to the condition of the patient. One may thus be deceived into a false security.

Pyrexia.—A great many patients, who afterwards develop blackwater, come into hospital looking very miserable, but with a temperature perhaps of only 99° F., and for a couple of days they

remain in this state, when suddenly, they get a rigor, and the temperature rises to 104° F., or even higher. In my experience, cases of this sort are more likely to do badly than the type of case that was quite well "yesterday," and "to-day" has a high, bounding temperature, and marked jaundice. A point I think worth noting, is to watch that the temperature and the amount of urine do not fall together. I do not like to see a temperature of 99° F. and only 30 ounces of urine marked "up." I then look for a sudden suppression, and only too often it occurs. The vomiting calls for no particular comment, save that it is very distressing and persistent. It makes it well-nigh impossible to adminster any drugs by the mouth, as they are all promptly returned. Patients usually complain of great pain in the back and limbs, and a severe headache is a constant symptom. I saw an erythematous rash in one case, but it disappeared very quickly. Personally, I gauge the efficacy of my treatment by the time the urine takes to becomes practically clear. This should happen any time after about forty-eight hours, but it often takes four or five days.

Treatment.

The exciting cause of blackwater is not merely a subject for academic discussion, but is a very vital point, as it must necessarily affect the treatment.

The lines upon which one may act are:—

(1) Anti-malarial, that is, according as one believes it to be a paludic hæmoglobinuria, or *vice versâ*; or (2) simply systematic, making no attempt at striking at any specific cause. This practically means a masterly inactivity. (1) of course will be combined with (2) as far as relieving distressing symptoms goes.

In a series of 20 cases, 8 have been treated with cassia bereana, *i.e.*, practically under (2); 10 have been treated solely with quinine by injections; 2 have been treated with atoxyl by injection. Under systematic treatment there has been one death. Under atoxyl there was also one death. I have never lost a case that has been treated by quinine. This gives a total mortality of 10 per cent.

Under (1) the line I take up is as follows: I give a simple soap and water enema and get the rectum well washed out. I then slowly syphon into the rectum the following: quinine sulphate 50 grains, ac. hydrochlor., dil. q.s. to get it in solution, warm water 3 ounces. A small medicinal enema like this I have found is always well retained. What I have always wanted to find out is how much of this is really absorbed. But the technique for its

estimation is elaborate and beyond my resources. At the most I do not expect more than one-half is absorbed, if as much. I give quinine by the rectum, as I am convinced that it is the most comfortable way. If the hypodermic method is used, say, under the skin of the arm, more often than not the arm remains painful for some days, no matter what aseptic precautions be used. Very much the same happens if quinine be injected, say, into the muscles of the buttock. I have used this method frequently for treatment of ordinary malaria, but after having seen many cases suffer very severe pain at the site of injection, have discarded it. I repeat the quinine enema after twenty-four hours. Thus I consider I have, at any rate, removed the cause, and any stray parasite that may have escaped the first administration falls a victim to the second.

The most distressing symptom, as I have already mentioned, is vomiting. This must be relieved at the earliest. In the milder cases an effervescent mixture may relieve it, but this is useless in the more severe cases. For some years past at the Military Hospital at Tower Hill, Sierra Leone, trial has been made of the liquid extract of cassia bereana, a root that has acquired some notoriety in Zanzibar. It is claimed that this drug has some specific action as well. I have never seen it do any good, and the best that can be said of it is that it has never been known to do any harm. I had two West Indian negroes with blackwater both admitted to hospital the same day. Both had a high temperature, about 104° F., and both were passing black urine in fair quantities. I gave the one quinine enemata, and the other 40 minims of liquid extract of cassia bereana, every two hours. The quininised patient's temperature dropped to normal in twelve hours, and did not rise again, and the following evening his urine was clear. The temperature of the other man came down by lysis, but his urine did not quite clear up for four days. I was greatly struck at the time by the contrast afforded by these two cases. The drug I rely on to stop the vomiting is morphine; I inject $\frac{1}{3}$ grain and repeat it after six hours. I also apply hot fomentations to the stomach area. It has failed me only once, the case being Corporal F., who vomited almost incessantly for twenty-four hours. I neglect the fact that there may be an accompanying nephritis in blackwater cases. The vomiting has to be stopped, and morphine is the only drug that I know of that will do it quickly. I have seen no ill-effects from the use of this drug. As soon as it seems likely that the patient can retain anything in his stomach, I return to quinine, which

I give in 5-grain doses every morning, accompanied with a tonic of iron and arsenic.

Those who do not believe in the efficacy of quinine, or rather those who believe it to be a positive danger, most usually fall back on the so-called "Sternberg treatment," as used for yellow fever. This consists in the administration of 10 grains of bicarbonate of soda, and 30 minims of liquid perchloride of mercury, to be taken every two hours, ice cold. The principle of the treatment in yellow fever is to "combat the acid diathesis."

Captain F. Harvey, R.A.M.C., has demonstrated that between soldiers in normal health and patients suffering from malaria there is no difference in the alkalinity of the blood. The same held good for a small series of blackwater cases that came under his notice. He then fed healthy natives on large quantities of carbonate of soda. It made not the slightest difference to their blood alkalinity. The theory of any acid diathesis in blackwater appears to be founded upon a coincidence of symptoms rather than upon scientific fact.

Treatment of Complications.—As long as the patient is secreting urine in fair quantity, that is, at least, 40 ounces per diem, I consider that he is progressing as well as may be expected, but when the quantity is diminishing, even if the temperature is falling, matters are not going so well. As I have remarked, this double fall is a kind of danger signal. I take it, there is a gradual mechanical blockage of the glomeruli in progress, and suppression is the next step. Two cases of practical total suppression I have met with yielded to a combination of a hot-air bath, 1 minim of croton oil, and the infusion of 4 pints of saline solution. In one case, by the time I had got the infusion apparatus ready, the patient was comatose and I had abandoned all hope of saving him. He rallied slightly after the infusion, and an hour afterwards had a most violent rigor; this was followed by profuse sweating, and he eventually passed 16 ounces of urine in the next twelve hours. An injection of pilocarpin is also an invaluable aid to the hot-air bath, &c.

Relapses are fairly common, and usually are a very serious complication. The mortality is generally high. Kohlstock, in the Kamerun, using no quinine, had no death in 8 cases. F. Plehn had 1 death out of 25 cases (4 per cent.), and A. Plehn lost 5 out of 53 (9·8 per cent.). These, apparently, were cases treated in hospital, for out of 53 treated outside 15 died (43 per cent.). The general average is stated to be about 20 per cent. Dr. Steuber,

in his observations on the employment of European troops in the Tropics, puts the mortality from blackwater after cholera and before enteric. A. Broden, writing from Leopoldville, mentioned the case of a doctor who gave injections of quinine (gramme 1·50 to 1·80 a day), and lost 7 cases out of 12 (58 per cent.). Some other mortality statistics are Steudel (German East Africa), 16 to 17 per cent.; Reynolds (Gold Coast), 50 per cent.; Beranger-Féraud (Senegal), 23 to 24 per cent.; Koch (German East Africa), 21 per cent.; and Schellong (Malay Archipelago), 42 per cent.

Pathology.

It may be said that there are no very characteristic pathological changes to be found *post-mortem*. There are no marked changes in the stomach; this affords a differential point between blackwater and yellow fever, if any be needed. The spleen is enlarged, and melanin occurs in the splenic cells. One would expect to find considerable damage done to the kidney, but this is not the case *post-mortem*. The kidneys have never been described as presenting anything like the changes found in nephritis. Stephens describes some degenerative changes in the convoluted tubules. Blood examinations give various readings. In an ordinary case the red blood corpuscle count yields about 3·5 millions per centimetre, but it may be as low as 1·8 millions. On the Coast, provided that quinine has not been taken in any quantity before the attack, the parasite of malignant tertian may be found more often than not. And even if the parasite be absent, great stress is now laid on the mononuclear increase and the excess of pigmented leucocytes as evidence of a previous or present malarial infection. This was pointed out by Christophers and Stephens as long ago as 1901.

Experimental Pathology.—Major W. H. Grattan, R.A.M.C., has, I understand, tried some inoculation experiments on animals, but no results are reported up to date. Captain F. Harvey, R.A.M.C., has done the same, and he allows me to say that he has met with no definite results so far. Dr. Nabarro tells me he obtained a result in a monkey, but did not follow it up.

Later Note.—Captain F. Harvey, R.A.M.C., kindly allowed me to see many of the *post-mortem* examinations he made on dogs and other animals that were being tried with injections of perchloride of mercury and atoxyl. In every case there was extreme congestion of the kidneys, which was most likely due to the atoxyl. It appears to me, therefore, that atoxyl is not a drug that should be further tried in blackwater.

NOTES ON THE CAUSATION AND PREVENTION OF ENTERIC FEVER IN INDIA, WITH REMARKS ON ITS DIAGNOSIS AND TREATMENT.

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During the period I was in command of the Ambala Station Hospital I recorded, in my "Report on the Medical Transactions and Prevailing Diseases" for the year 1905, certain conclusions arrived at concerning the causation of enteric fever in that station, and detailed the prophylactic measures which were adopted with the view of mitigating its incidence. The Medical Division, Army Headquarters, India, subsequently published a *précis* of this report in a Circular Memorandum, No. 1,858, of April 24th, 1906. During 1907, while in command of the Kasauli Station Hospital, I have gained additional experience regarding certain factors concerned in the causation of this disease—factors which have suggested new methods of prophylaxis. A statement of these may be of interest. There is, perhaps, nothing new or original in what follows, but the publication of practical experience is always of some value.

In this paper, therefore, it is proposed to treat of:—I.—What are believed to be the most important factors in the causation of enteric fever in India. II.—The prophylactic measures which it is suggested should be adopted to counteract these agencies. III.—Experience gained with regard to the diagnosis and treatment of this disease.

I.—Important Factors in Causation.

(1) *The Chronic Bacillus-carrier* (*Bacillenträger*).—The following interesting facts in connection with this channel of infection were recently observed at Kasauli:—

(*a*) Four cases of enteric fever were admitted to hospital, between August 6th and 18th, 1907, from a detachment of the 1st Bedfordshire Regiment. This detachment was accommodated in two barrack-buildings situated at some little distance apart from the rest of the barracks. Two of the cases lived in the one building, two in the other. No two cases inhabited the same room in the barrack. There was no relation in the life-history of the men. No case of enteric fever, or of any pyrexial condition in any way resembling it, had occurred among the detachment since the

previous April, when an imported case had been noted. Enteric fever was not prevalent among other detachments of the garrison. A thorough inspection of the sanitary environment of the detachment, of its water, dairy produce, and other food-supplies, failed to reveal any adequate cause for the outbreak. The sanitary precautions ordered to be adopted in such cases, by Army Headquarters and Divisional authority, were at once carried out, and in addition the whole detachment was moved into a sanitary camp situated five miles out of the station. It may here be mentioned that no further cases occurred.

Being anxious to thoroughly enquire into the causation of what appeared to be a most inexplicable outbreak, I invoked the aid of the Acting Director of the Central Research Institute of India, the distinguished scientist, Captain E. D. W. Greig, I.M.S. That officer at once suggested, after failure to discover any local insanitary condition likely to have given rise to the epidemic, that search should be made for the presence of a chronic bacillus-carrier among the detachment, as the most likely source of infection. It was determined to examine the excreta of the entire detachment in the following order: (1) Cooks; (2) all men who had acted as nursing-orderlies to enteric fever cases; (3) contacts; (4) rest of detachment. A bacillus-carrier was at once found in the first category. This was a strong and healthy soldier, aged 31, service thirteen years, who for seven years had not been under treatment in hospital; he was discovered to be excreting large quantities of *Bacillus typhosus* in his fæces. No other bacillus-carrier was found in the detachment. This man did not live in the same room with any of the four cases seized with enteric fever. He had, however, assisted in cooking and preparing their food. It was assumed that this man was the cause of the epidemic.

The question now arises, How did this man convey infection to his comrades? The obvious answer is, by infecting their food while acting in his capacity of detachment cook. Although this mode of infection is possible, I am not disposed to unhesitatingly accept it. A most careful observer, and one whose opinions must always be received with respect, Colonel D. O'Sullivan, A.M.S., stated to the Enteric Fever Commission that he had paid constant attention to the process of cooking usually adopted in barracks, and that he could aver, from personal experience, that food once placed in the cooking-pot is seldom, if ever, again handled by the cooks. The above refers to the cooking of the meat and vegetable ration. Less chance of infection in the cook-house would

occur in the case of the grocery ration. Bread and dairy produce are seldom handled by the cooks. Moreover, unless my sanitary regulations are flagrantly neglected, the hands of all cooks employed in barrack and other kitchens are carefully cleansed by scrubbing with soap and an antiseptic solution (provided in all kitchens) both before and during culinary operations.

(*b*) My other experience of the chronic bacillus-carrier, culled from a different sphere of military life, was as follows: In reducing the nursing establishment of the Station Hospital, four orderlies, who had been employed exclusively in nursing enteric fever cases, were returned to duty. These men were all in perfect health; none had been inoculated, nor had had enteric fever. While employed as nurses they lived together in a separate tent. On return to barracks, they were, as a precautionary measure, segregated, and their excreta examined. Two out of the four were found to be enteric bacillus-carriers; in both the fæces were infective.

Now if the chronic bacillus-carrier is as capable of transmitting infection as some authorities believe, why did not the two infected men convey the disease to their comrades who had lived for some months in such close relations with them? "They were immune" must, I suppose, be the answer. With the utmost deference, I submit an alternative theory. The chronic typhoid-carrier is frequently not more capable of causing an outbreak of enteric fever than the chronic Fränkel's-pneumonococcus-carrier is of causing an outbreak of pneumonia, or than the chronic diphtheria-bacillus-carrier is of producing an epidemic of diphtheria. In other words, the bacillus of these chronic carriers is not of an active, highly infective character.

(2) *Personal Contact.*—Under this heading it is proposed to narrate further personal experiences of great interest. Armourer-Serjeant W., 1st Royal Scots Fusiliers, quartered at Bareilly, complained of "feeling out of sorts," and of cough and loss of appetite, and obtained furlough to visit his wife, who was residing at Kasauli. He came under medical surveillance at once on arrival, and was treated, out of hospital, for about three weeks for bronchial catarrh and general malaise. No rise of temperature was discovered. Apical bronchitis and loss of flesh led to his admission to hospital on August 11th, 1907, tubercle of the lungs being suspected, and he was accordingly isolated. Three days after admission to hospital he developed a severe pyrexia, the lung lesion at once disappearing. A blood culture revealed the presence of the *B. typhosus*, and a severe and prolonged attack of enteric fever

followed. On August 16th, 1907, five days after his admission, his wife, who previous to his arrival had been in excellent health, was admitted to hospital with a well-developed attack of enteric fever, a severe pyæmic form of the disease. There can be no doubt that the husband had infected the wife.

It is assumed that, in the case of Serjeant W., the primary infection had occurred in the bronchial passages. It is much to be regretted that no examination of the sputum for *B. typhosus* was made; but, as before related, on the supervention of pyrexia, and previous to any suspicion of enteric fever, the primary lung lesion entirely disappeared.

(3) *Enteric Fever Convalescents.*—At Kasauli, during 1907, eighty-six enteric convalescents have, up to date, passed through my hands, and come under scientific observation at the Central Research Institute of India. Of this number, ten were found to be excreting the *B. typhosus*, in their urine or fæces, for periods longer than two months, *i.e.*, 11·6 per cent. The intermittency of excretion of the bacillus, both as regards urine and fæces, was a marked feature in many of the cases, this intermittent period often extending to two months or more. It has been found that the urine most frequently first becomes infective, and that its infectivity disappears correspondingly early. The fæces are infected later, and infection persists longer than in the case of the urine.

Such convalescents as those just referred to may be termed acute bacillus-carriers, and are, in my opinion, highly infective, being capable of spreading the disease broadcast. The danger of quartering such cases in barracks, in spite of strict segregation, is obvious. During 1907, at Kasauli, as many as fifty convalescents have been segregated at one time in a barrack-building, no suitable site for a standing camp being available. Their presence has been a constant source of anxiety to the medical authorities, as may be readily understood. In these declared cases, however, sanitary precautions meet with a certain amount of success in preventing the propagation of the disease. It is the mild cases of enteric, which are not recognised as such, that are probably the agents of widespread epidemics. The importance of accurate diagnosis in all cases of fever cannot, therefore, be over-estimated. This subject will be referred to hereafter under my remarks on diagnosis.

(4) *Flies: Latrine and Urinal Infection.*—These two causative factors are bracketed, as flies, most probably, are the chief agents by which infective material, gleaned from urinals and latrines, is conveyed to man. It is also possible that the highly absorbent

latrine-pan at present in almost general use in India, may be a channel of infection.

With reference to the fly theory of infection, attention may be directed to the fact that the seasons of the year during which these pests are most numerous are also those during which there exists the greatest seasonal prevalence of enteric fever. It would appear that freshly excreted urine and fæces are most highly infective, as the extra-corporeal life of the *B. typhosus* is a remarkably short one; for instance, bacilluric urine placed in a specimen glass, and then kept in a room at the ordinary temperature, becomes sterile in twenty-four hours. Flies are abundant in most urinals and latrines, and, if given access to freshly voided infective excreta, may readily convey infection to various food supplies in the neighbouring kitchens and barrack-rooms. The writer believes flies to be the channel by which enteric fever is most frequently propagated in India.

After this brief account of the manner in which it is believed enteric fever in India is more generally disseminated, it is now proposed to describe certain prophylactic measures, the adoption of which, it is suggested, may lead to considerable reduction in the incidence of the disease.

II.—Prophylactic Measures Suggested for Adoption.

(1) *Inoculation.*—It would seem almost obvious that the fewer the foci providing infective material, the less chance is there of any particular infectious disease being disseminated—in other words, the fewer the number of cases of enteric fever that occur in a station, the less danger is there of that disease becoming widely prevalent. I believe this desirable consummation will be arrived at by general inoculation—the inoculation of all soldiers being made compulsory. From my knowledge of the frame of mind of the recruit on entering the Service, I do not apprehend that any insuperable difficulty will be experienced in inducing him to promise to undergo this operation, and a clause to this effect might be inserted in his attestation sheet.

The duration of immunity conferred after one (double) inoculation operation is not yet determined. German experience in South-west Africa points to twelve months as the period. If a soldier were inoculated just previous to embarkation for India, and the operation were repeated after six months' interval, it is reasonable to conclude that this procedure would tide him over the most

susceptible period of his residence in that country. Future experience, however, will indicate the proper course to pursue. It may be here recorded that the serum used in India, supplied from the laboratory of the Royal Army Medical College, causes few or no unpleasant symptoms after inoculation. Out of fifty men inoculated at Kasauli, none admitted that they had suffered any marked inconvenience from it. A suggestion made to me by Lieutenant-Colonel D. Semple regarding the preparation of the serum may be here mentioned, viz., that an Indian strain of bacillus might prove more efficacious than the English one, if used for men intended for Indian service.

I have not gathered much personal experience as to statistics regarding the efficacy of inoculation, but think it worth relating what has come to my notice on this point in my recent experience at Kasauli. Out of the eighty-six cases of enteric fever previously recorded as having come under observation here, only one had been inoculated, a single operation only having been performed. This case developed the disease at Kasauli, and therefore came under my personal observation. The mildness of the attack was remarkable, for, beyond a mild pyrexia, there was little evidence of serious illness, and convalescence was soon established and proved uneventful. If blood culture had not compelled the diagnosis of enteric fever, clinical evidence would most assuredly have led to one of simple continued fever.

(2) *The Establishment of Special Cantonments or Hutted Camps for the Reception of Enteric Convalescents.*—In my report on enteric fever at Ambala for the year 1905, previously referred to, the systematic use of a central segregation camp for enteric convalescents was mentioned as one of the sanitary improvements which was believed to have had the most beneficial results in reducing the incidence of enteric fever at that station. The convalescents were virtually isolated in a standing camp, situated at some considerable distance from any barracks. No definite period was laid down for their detention in this camp, but they were never discharged until after three months' convalescence, and until bacteriological examination showed an absence of bacilluria. This form of isolation was all very well in its way, but later experience has taught me the following weak points in the scheme: (*a*) No provision was made for the accommodation of convalescent officers and their families, nor for the families of the rank and file. (*b*) The examination of the excreta was confined to the urine, and this was not carried out periodically and systematically. No examination of the fæces could

be undertaken. (*e*) Residence in such a camp was possible only during the cold weather. Due consideration of the above shortcomings led me to submit the following scheme for consideration at the last meeting of the Enteric Fever Commission.

Special hutted camps should be provided, at selected sites, for the isolation of enteric fever convalescents. Such camps should provide accommodation for all ranks and their families. In organising these isolation cantonments, the following points are brought forward for consideration :—

(*a*) The necessity for a well-equipped laboratory on the spot with an expert bacteriologist in charge, thus rendering possible the daily systematic examination of the excreta of all convalescents.

(*b*) The introduction of a well-arranged system of transport of convalescents, from the hospital at which they were originally treated, to the isolation camp, in order to preclude the possibility of spreading contagion *en route.*

(*c*) Arrangements for training the inmates of such camps in their ordinary military duties, such as musketry, signalling, &c.

(3) *An Improved Conservancy System.*—The modified dry-earth system so long in use in India is almost universally condemned, and it is generally admitted by sanitarians that the only satisfactory form of conservancy is that known as the "water-carriage." Such a system would practically almost abolish the causation of enteric fever by "latrine infection." The difficulties of inaugurating such a system in India are considerable, the principal ones being : (*a*) Expense ; (*b*) difficulty in finding sufficient "fall" for the flow of sewage in many stations in the plains, and the enhanced cost thus likely to accrue in providing the necessary pumping plant; (*c*) the shortage of water in the majority of stations.

Consideration of these difficulties prompted me to suggest to the Enteric Fever Commission a modified form of water-carriage system, with an improved pattern of latrine and urinal. The form of conservancy advocated may roughly be described as a trough water-closet and urinal, with removal by a specially designed tank on a mono-rail car. The following is a detailed description of the above :—

(1) The latrine shed (floor, roof, and partitions) is made of reinforced concrete, no wood at all being used in its construction.

(2) The accommodation is for a double company, the latrine shed consisting of two divisions, with eight compartments, with a urinal in each division.

(3) Each compartment has a self-closing steel-tube-framed door.

(4) The seats and walls of the latrines are of polished concrete. The top of the latrine seat is sloped towards the back, necessitating the user sitting in the best position and bringing the fæces directly over the hole connecting the pan with the pipe-trough.

(5) Cast-iron, enamelled, and glass-lined latrine pans.

(6) Latrine pans discharge into an 8-inch glass-lined cast-iron pipe.

(7) The trap at the outlet end of this pipe is constructed with a weir, so that at least 5 inches of water will always remain in the pipe-trough, and fæces falling from the pan into the trough will fall into water and not adhere to the lining.

(8) The smell escapes by a vent-pipe from the trap to the upper air. This trap contains also a water-seal, preventing any smell from the mono-rail tank finding its way back to the latrine.

(9) The pipe-trough is flushed with the ablutionary and cook-house water from a tank on the roof of the latrine (15).

(10) The fæces and paper in the pipe-trough float to the trap (7), and, as water is added to the quantity in the pipe-trough, they float through the trap direct into the mono-rail tank waggon.

(11) The mono-rail tank waggon is made on the system of a boat-shaped baby's bottle, so that the contents can be emptied with the least possible delay and the waggon cleansed thoroughly. On arriving at the septic tank the waggon is turned over by hand or by an arrangement of screw-jacks. The mouth of the waggon is closed by an air-tight cover. The waggon contains 200 or 250 gallons.

(12) The latrine seats and trough are flushed periodically by the sweeper in charge, who simply has to turn on a tap connected with a storage tank built at a suitable level.

(13) The urinal is placed against the screen wall of the latrine, and consists of thick sheet-glass (built into the concrete) against which it is intended that the urine should be voided. The urine drops into a channel below, and flows into the latrine pipe-trough. The urine, before leaving the pipe-trough, flows into a grit-chamber, through pipes entering this chamber at opposite ends of a diameter, whereby any grit coming from the urinals is carried by the swirl in the water to the outer side of the chamber, and the liquid falls over the weir into the pipe leading to the trough. The grit-chamber is cleaned by opening a hopper door in its bottom and at once discharging its contents into a handcart or other conveyance.

(14) The urinal is flushed from the tank on the roof of the latrine (9). There are two pipes connected with this tank, one through which water flows to flush the latrines, and another through which it flows to flush the urinal.

(15) The tank on the roof contains about 500 gallons of sullage water. This water is turned into the latrines and urinals at will by the use of two taps, one on each of the two pipes mentioned in paragraph 14.

(16) This tank is filled from a covered concrete sump by means of a 1½-inch hand pump, with pipe connections from the sump to the tank.

(17) The sump is filled from the wash-houses and cook-houses, with which it is connected by concrete, cement-lined, open channels. It contains about 1,500 gallons.

(18) The cook-house sullage water is filtered through a cheap form of charcoal grease-trap.

The following diagram may assist in illustrating the proposed system. It is claimed for this form of conservancy: (*a*) That it fulfils all the requirements of a water-carriage system; (*b*) solves the difficulty of shortage of water and necessity of pumping arrangements; (*c*) provides a sanitary form of combined latrine and urinal; (*d*) disposes of that vexed sanitary question in India, how to get rid of lavatory and kitchen sullage water.

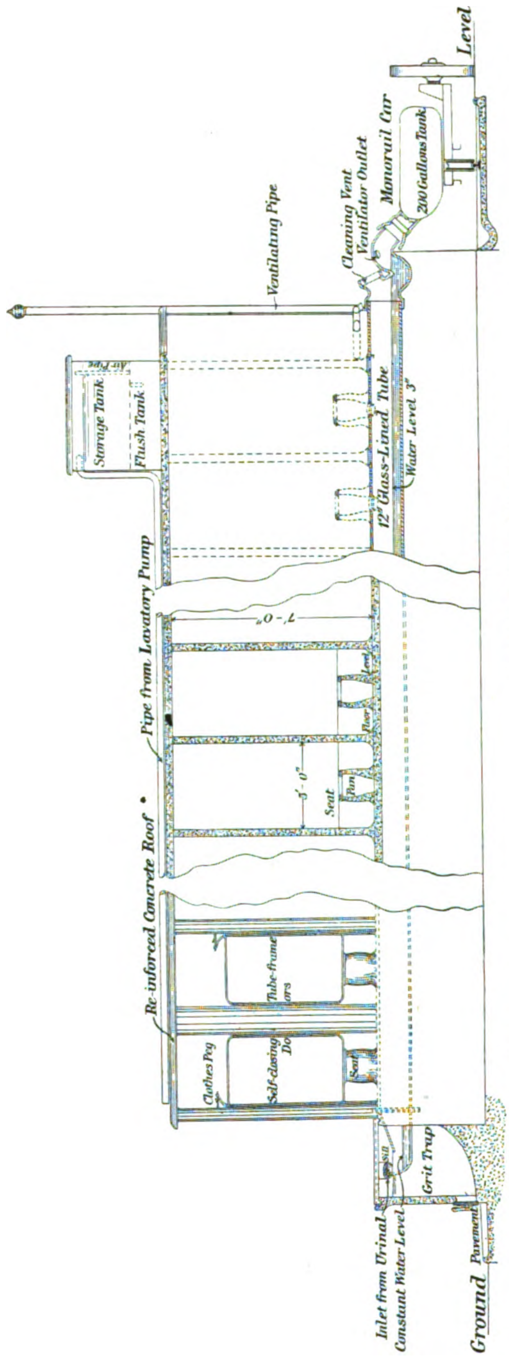
The above completes my remarks on the etiology and prophylaxis of enteric fever in India. It must not be concluded that the writer does not recognise other possible avenues of infection, or numerous other necessary sanitary precautions, but a description of these would entail an article of inordinate length.

I now propose to deal with the important subject of

III.—The Diagnosis and Treatment of Enteric Fever.

Accuracy in the diagnosis of the true character of Indian fevers is the pivot on which the whole problem of their prophylaxis turns. Failing an accurate diagnosis, efforts to stamp out enteric fever in India are obviously doomed to failure. In cases presenting all the classical clinical phenomena, with an early positive Widal reaction, the task is comparatively easy. It is in the very mild attacks, with a Widal reaction not obtainable until convalescence is established, that difficulty presents itself, and in which the true nature of the disease is frequently overlooked. Such cases return to barrack life without any sanitary precautions having been adopted, and are potential factors in spreading the disease broadcast in their unit.

In no disease is the clinician so dependent on the aid of bacteriological science for accurate diagnosis as in these mild cases of enteric fever. By the process of blood culture all difficulty in recognising these cases is removed. Enteric fever is a bacteriæmia



ELEVATION.
Showing doors.

LONGITUDINAL SECTION.
Showing seats. Showing trough, &c.

from a very early stage of the disease, even in the incubation period; hence the value of this process as a means of early diagnosis. Moreover, by early recognition of the true nature of the attack, the necessary prompt sanitary measures can at once be undertaken. It is essential, therefore, that the process of blood culture should be established as a routine measure in all cases of continued fever.

Two examples in which the true nature of an attack of fever was overlooked have recently come under my notice, and are worthy of a short description :—

Case 1.—Sent up to Kasauli as convalescent after an attack of "ague," for which he had been under treatment in hospital for twenty-one days. There was no mention on his medical history sheet that any blood examination whatever had been made. The man's appearance, one of marked ill-health, led to examination of his blood and excreta. The former gave a positive reaction in a dilution of 1 in 40, by Widal's test (B.T.), and the urine was found to be swarming with *B. typhosus*.

Case 2.—Sent up as a convalescent after an attack of "simple continued fever," for which he had been under treatment in hospital for twenty-seven days. On his medical history sheet it was noted that at no period of his illness had blood examination revealed a positive reaction by Widal's test (B.T.). On arrival at Kasauli, blood examination gave at first a positive reaction by Widal's test in a dilution of 1 in 40, later in dilutions of 1 in 80 (B.T.). The excreta were not found infective. (The man had never been inoculated against enteric fever.)

It now only remains for me to narrate a recent valuable experience gained with regard to the treatment of enteric. At Kasauli, we were in the habit of treating our cases of enteric fever by what is generally known as the "empty bowel" method of treatment, the essentials of which are: (1) A diet composed entirely of milk-whey; (2) the exhibition of a small dose of calomel every night, followed by castor oil the next morning. A severe case of enteric fever was under treatment by this method; his condition was one of extreme danger, and the gravity of the prognosis was increased by a markedly dropping opsonic index. At this juncture, Lieutenant-Colonel D. Semple brought to my notice the fact that an eminent authority held that the exhibition of mercury in such cases tended to prevent the formation of "protective bodies" in the system. The hint was taken, and the dose of calomel at once discontinued. The patient's opsonic index at once began to rise rapidly, and he eventually made a good recovery.

PLAGUE.

By Lieutenant-Colonel C. BIRT.

Royal Army Medical Corps.

A notice of the first two reports on plague investigations in India was inserted in the Journal of the Royal Army Medical Corps for January, 1908. The third report has been issued as an extra number of the *Journal of Hygiene* for December, 1907. It contains a digest of recent observations on the epidemiology of plague and a study of the disease in Bombay and some neighbouring villages, and in two villages of the Punjab. There is another report in the press, but Major G. Lamb, the able President of the Committee, has prepared a summary[1] of the whole work. This epitome cannot be commended too highly. It contains a lucid and convincing exposition of the evidence on which the following conclusions are based :—

(1) Pneumonic plague is highly contagious. It is, however, rare (less than 3 per cent. of all cases) and plays a very small part in the general spread of the disease. (2) Bubonic plague in man is entirely dependent on the disease in the rat. (3) The infection is conveyed from rat to rat, and from rat to man, solely by means of the rat-flea. (4) A case of bubonic plague in man is not in itself infectious. (5) A large majority of plague cases occur singly in houses. When more than one case occurs in a house, the attacks are generally nearly simultaneous. (6) Plague is usually conveyed from place to place by imported rat-fleas, which are carried by people on their persons or in their baggage. The human agent not infrequently himself escapes infection. (7) Insanitary conditions have no relation to the occurrence of plague, except in so far as they favour infestation by rats. (8) The non-epidemic season is bridged over by acute plague in the rat, accompanied by a few cases amongst human beings.

The occurrence of plague epizoötics in rats which have preceded epidemics has been observed in Hong Kong, Japan, Johannesburg, Cape Colony, Mauritius, Egypt, Odessa, Argentine Republic, and in the Callao and Pisco outbreaks near Lima. The latest corroborative

[1] "The Etiology and Epidemiology of Plague." A summary of the work of the Plague Commission, issued under the authority of the Government of India. Calcutta: Superintendent of Government Printing, India. Price, 4 annas, or 5d.

testimony is to be found in the comprehensive report of Dr. Burnett Ham, Commissioner of Public Health of Queensland, on the annual epidemics in that Colony from 1900 to 1907.[1] In this report there is also a full account of the life-history and habits of fleas, embodying all the recent observations scattered through biological literature. It is illustrated with numerous photomicrographs. It is an invaluable monograph. In Queensland, as in India, rat mortality invariably ushered in the epidemics, and the epizoötics and epidemics prevailed at certain seasons (April, May, and June), which could be anticipated.

As the rat holds such a predominant position in the epidemiology of plague, a short description of the species and habits of these rodents may be of interest.

Mus rattus, the "Old English," "Alexandrine," or "Black" rat, is distinguished by possessing a tail longer than its head and body together. The tail is black, ringed and pointed. The nose long and pointed. The ears large and thin. The teeth and claws sharp and pointed. Though called the "Black" rat, the colour of its back is usually brown, and of its abdomen greyish, yellowish, or white.

Mus decumanus, the common grey or brown, Norwegian or Hanoverian, sewer rat, has a tail shorter than its head and body together. The tail is brownish and is blunt at the end. The nose is short and blunt, the ears are short and thick, the teeth chisel-shaped, and the claws blunt. The colour of its fur is more constant than that of *M. rattus*, brownish-grey on back, lighter grey on abdomen.

Nosokia bengalensis, the mole rat, is larger than either of the former. Its tail is shorter in proportion to the length of the body than that of *M. decumanus*. Its fur is thin and bristly, and the soles of the feet differ from those of *M. decumanus* and *rattus*.

M. rattus is a house rat. It inhabits every part from the roof downwards. It is a nimble climber and is very agile. Its nests are generally in accumulations of rubbish, in recesses, &c., though sometimes it burrows. It is a grain eater, can be tamed, and is secured from molestation by some Indian natives (Jains).

M. decumanus haunts sewers, drains, stables, and the lower storeys of houses. It has never been found above the third floor in Bombay. It has remarkable powers of gnawing through hard

[1] The Report of Plague in Queensland, 1900-1907," by B. Burnett Ham, M.D., Commissioner of Public Health. Brisbane: G. A. Vaughan, Government Printer.

materials in making its burrows where it constructs its nests. It is not so prone to climb and leap as *M. rattus*. It has cannibalistic propensities. It is difficult to keep alive in captivity.

It is usually supposed that *M. rattus*, or the "Black" rat, is extinct in England, driven out by *M. decumanus*, introduced at the time of accession of the Hanoverian Kings. Sir Ray Lankester states that this is a mistake, and that, indeed, *M. rattus* is not very rare. In many localities in England they outnumber the Norwegian rat. Moreover, the rodents which infest ships are of the *M. rattus* species in the majority of instances. That there is no deadly feud between the two is shown by the fact that the lower floors of the houses in Bombay are their common meeting place.

The *N. bengalensis* resembles *M. decumanus* in its habits.

M. rattus outnumbers *M. decumanus* in Bombay in the proportion of seven to three. This is somewhat surprising, since there is an average of five in a litter of *M. rattus* and of eight in a litter of *M. decumanus*. In the Punjab, the rat population is almost entirely composed of *M. rattus*. On the other hand, in Australia, *M. decumanus* is three or four times as numerous as *M. rattus*. *N. bengalensis* is very common in Calcutta, but is rare in Bombay. The rat infestation of Indian dwellings is very great. Every house harbours its colony. In one year the number of rats trapped exceeded that of the population of certain villages. Six months later, these pests seemed to be as numerous as before. The Bombay statistics show that *M. decumanus* is twice as liable to be infested with plague as *M. rattus*. This is accounted for by the fact that on the former twice as many fleas are found as on the latter.

The curves of the epizoötic among *M. decumanus*, among *M. rattus*, and of the epidemic in man do not lie one over another. The *M. decumanus* curve precedes that of the *M. rattus* by ten days, and that of the *M. rattus* precedes the curve of the human epidemic by eleven days. A mathematical analysis of the figures discloses a high correlation between the incidence of plague in *M. decumanus* and *M. rattus*, and a still higher relationship between plague in *M. rattus* and man. From its out-door life and wandering habits *M. decumanus* is responsible for the diffusion of the epizoötic throughout Bombay. It conveys the infection to the more domesticated *M. rattus* in their common meeting place, the lower floors of the houses. The fleas of *M. rattus* carry the *Bacillus pestis* to man. In Australia, though *M. decumanus* out-

numbers *M. rattus*, the incidence of the epizoötic is greater in the latter. Where successive human outbreaks have occurred, *M. rattus* always has been found infected. Epizoötics have been noted in *M. decumanus* without a resulting epidemic in man. Thus eighty-eight specimens of *M. decumanus* were discovered dead of plague in a produce store in Brisbane in 1904. None of the employees were attacked. Nevertheless, there is the instance of the troopship "Antillean," which was infested with *M. decumanus* only. An epizoötic among these rats gave rise to an epidemic. In the non-epidemic season in Bombay, acute rat-plague persists in *M. decumanus*, but does not occur in *M. rattus*. In the Punjab, chronic rat-plague has been discovered to exist in *M. rattus* in the intervals between human epidemics.

Mice are less liable to contract plague than rats. In Sydney, 13 per 1,000 mice were infected during the rat epizoötic. The mouse is also a host of the rat-flea, *Pulex cheopis*. Mice appear to play little or no part in the propagation of plague in India. Altogether, in only sixty-three mice was the disease detected. The musk-rat, *Crocidura cærulea*, is a shrew, and is immune to the *B. pestis*. Naturally induced epizoötics have been observed in squirrels, guinea-pigs, rabbits and monkeys.

A striking experiment demonstrating the *rôle* of the rat-flea in the propagation of plague was made in a small village near Bombay. As soon as dead rats and a few human cases of plague had occurred, the inhabitants left *en masse*. The commission then substituted guinea-pigs for the human population. Guinea-pigs, though not naturally the hosts of fleas, form efficient traps for them when they desert the carcases of rats. Seventy per cent. of these guinea-pigs succumbed to plague, although preserved from the attacks of rats and fed with uncontaminated food. The epizoötic in the guinea-pigs was co-extensive and coincident with that in the rats. The average number of rat-fleas caught on the plague-infected guinea-pigs was fifteen, while on those which remained healthy it was three only. Moreover, in the stomachs of some of the fleas captured on the plague guinea-pigs *B. pestis* was found.

The seasonal prevalence of plague is intimately bound up with the seasonal prevalence of fleas. In Bombay, in the Punjab, in New South Wales and in Queensland the plague epidemics have been synchronous with a rise in the number of rat-fleas. It has been noted in Australia that patches of sandy ground far removed from dwellings may swarm with fleas immediately before an

outbreak. The advent of rain may drive them into houses, but a heavy and continuous downfall is inimical to them. A temperature of 85° F. and upwards exerts an unfavourable influence on the breeding of fleas, and on the survival of the *B. pestis* on their stomachs. Therefore the plague epidemic dies out when the mean temperature attains this limit. A low temperature, 50° F. for instance, causes the infection in the rat to pursue its course more rapidly. Many of these rodents then die before the bacilli invade the blood. Consequently a rise in the epizootic curve depends on (1) a mean temperature of 50° to 85° F.; (2) a sufficient number of susceptible rats; (3) a sufficient number of rat-fleas. Plague epizoötics diminish temporarily the rat population, and increase the proportion of immune animals. This immunity is not transmitted to the next generation, so that as breeding is especially vigorous during the intervals between the epizoötics, a large number of susceptible young are then born.

In many works on plague, its serum treatment is dismissed with but scanty notice. E. Dujardin-Beaumetz has remedied this defect by collecting in a critical summary[1] all the results published. He quotes Penna, of Buenos Ayres, who has treated 204 patients by intravenous injections of 100 cc. of anti-plague serum, repeated once or twice. The mortality was 14·2 per cent. The usual death-rate of plague varies from 60 to 95 per cent. G. Cruz has reported a reduction of the mortality to 23 per cent. in 1,765 Rio Janeiro and Campos cases to whom the serum was administered intravenously. Burnett Ham states that the serum treatment of plague has been carried out in Queensland in the annual epidemics of 1901-1907. In 198 instances in which the serum was injected intravenously or subcutaneously the death-rate was 30 per cent. On the other hand, 74 per cent. of forty-six patients who were not thus treated succumbed. He is of opinion that if the serum be given early in sufficient doses nearly every case of bubonic plague not attended with complications should recover. He states that its administration is quickly followed by a sudden fall of body temperature, a moist skin and profuse perspiration. There is a marked and rapid improvement in the mental condition. Coma and delirium disappear. Pulse and respiration improve. The routine treatment is to give 120 cc. immediately, and 100 cc. or more twelve hours later if the pyrexia continues—intravenously if the symptoms are

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[1] "Revue La Sérothérapie de la Peste," par le Dr. Ed. Dujardin-Beaumetz, *Bulletin de l'Institut Pasteur*, Tome iv., 474, June 15th, 1906.

severe. This confirms the conclusion drawn by Dujardin-Beaumetz. This author asserts that a veritable crisis ensues after the intravenous injection of large doses of serum. The sufferer becomes restless, the pulse quickens, and the eyes roll. Cyanosis and active delirium come on, succeeded by profuse perspirations, rigors and incoördinate movements. The respiration may become stertorous. Then follows a period of calm. A drop in the temperature and a feeling of well-being are the prelude of a speedy recovery. He sums up by insisting on the necessity of the intravenous administration of large doses of anti-plague serum to all plague victims. It seems probable that this method might be profitably combined with the use of very small doses of anti-plague vaccine introduced *sub cute*, in order to excite the tissues to elaborate protective substances at the site of inoculation.

Haffkine's latest communication on the subject of preventive inoculation is recorded in the *Proceedings of the Royal Society of Medicine*, Epidemiological Section, January, 1908.[1] The Indian experience during the last ten years shows :—

(1) That in a native of India, who is more susceptible to the disease than African, European, and some other races, the inoculation now in force reduces the liability to attack to less than one-third of what it is in a non-inoculated Indian.

(2) That in one-third of the cases which still occur, the recovery rate is at least double that in the non-inoculated attacked, the ultimate result being a reduction of the plague mortality by some 85 per cent. of what it is in non-inoculated Indians.

(3) *That in an inoculated European an attack of plague, if it subsequently occurs, has, so far, always ended in recovery.*

(4) That the inoculation is applicable to persons already infected and incubating the plague, and prevents the appearance of symptoms, or else mitigates the attack, a fact which disclosed a basis for the bacterio-therapeutic treatment of disease.

(5) That in natives of India the degree of immunity conferred by the inoculation, though gradually vanishing, seems to last during several outbreaks of plague.

(6) That in Europeans the effect has not yet been seen to disappear during the time that this inoculation has been under investigation since 1897.

As concrete examples may portray more forcibly the virtues of

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[1] *Proceedings of the Royal Society of Medicine*, vol. i., No. 3, Epidemiological Section, p. 79, January, 1908.

any measure than general conclusions will do, the following illustration of the great service rendered by anti-plague vaccination may be cited. The members and assistants of the Indian Plague Commission were daily exposed to the danger of infection; yet, with one exception, they all escaped the plague by inoculation with Haffkine's prophylactic. That the risk they ran was no chimerical one, is shown by the fact that a native who came in search of employment and stood near the place where dead rats were being examined, sickened of plague and died. The solitary exception referred to above occurred in a native assistant who had been inoculated; he recovered.

It might be thought that plague could be stayed in India by the erection of rat-proof dwellings. But when we consider how many well-built European houses harbour mice and that the *M. rattus* in India occupies the position of *M. musculus* in England, we may pause awhile. A sad instance of how singularly ineffectual the best laid schemes of sanitary improvement may be is afforded by the experience of the Bombay City Improvement Trust. That philanthropic body erected "rat-proof" buildings in 1906, so constructed that they could offer no shelter for vermin. Yet these model dwellings soon become infested with *M. rattus*. Plague broke out and 57 out of the 4,000 inhabitants were stricken. The remainder escaped death by fleeing from these sanatoria and betaking themselves to rude huts fragilely built of sticks and matting.

In Queensland, phosphorus incorporated with syrup and flour, spread on thin bread and scented with oil of aniseed or rhodium proved more destructive to rats than other poisons, bacterial or chemical. The Danysz Virus and its analogues, and there are many of them—"Azoa," "Liverpool Rat Poison," "Laroche Rat Virus," "Pasteur Vaccine Company's Virus," "Rattin"—all labour under the disadvantage of rapid loss of virulence. Even if this is maintained by passage through animals the results are fairly satisfactory only. The rats appear to become immune. The most effective mode of ridding ships of rodents is by pumping in dry sulphur dioxide by means of the Clayton disinfecting apparatus.

page 520

Editorial.

In the article on "The New Geneva Convention," published in the last number of the Journal, an impression has been produced by the notes on Article 13, which is much regretted. The author, who is alone responsible for the notes, gives an utterly false conception of the attitude of our allies towards pay of their officers and towards religion. Although he under-estimates the pay mentioned by him by about 2,000 per cent., he forgets that patriotism, not pay, is their motive in war, and that no nation is more tolerant of religious creeds, or has a greater sense of true religion, than the courteous, high-minded, and friendly people who are our allies.

Clinical and other Notes.

SOME UNUSUAL CASES OF MALINGERING AND THEIR ELUCIDATION.

By Captain F. E. WOOD,
Malay States Guides,
and
W. BRYCE ORME,
District Surgeon, *Larut.*

Numerous as are the many artifices employed by persons for the purpose of deception, yet it is somewhat infrequent that an organised attempt should be made by a number of men to deceive the doctor by so clever an imitation of actual disease as was employed in the cases about to be described. Cases of malingering have given us considerable trouble, and we consider that it would be of general interest to the profession to give an account of some which, though in themselves giving no indication of their cause, were subsequently proved by experiment to be due to irritation caused by an Indian drug commonly known as "Marking-nut" (Hind., *Bhilavan*), *Semecarpus anacardium.*

These cases presented in greater or less intensity the following points: (1) A previous abrasion (one case excepted); followed at an interval by

(2) acute inflammation of the skin with subcutaneous œdema, the latter subsequently becoming solid and the part brawny; (3) the complete absence in all cases of any lymphangitis or glandular enlargement; (4) constitutional disturbance, slight or entirely absent.

In the first two cases which came to our notice the following probable causes were thought of: (1) bacterial; (2) protozoal; (3) artificial.

(1) *A Local Bacterial Infection.*—This was searched for microscopically, both in scrapings from the surface and by puncture, with negative results (having no culture media we were unable to investigate the case bacteriologically). The entire absence of lymphatic envolvment and constitutional disturbance which one would expect to accompany so acute an inflammation led us to put this idea on one side.

(2) *Acute Local Exacerbation of Elephantiasis.*—With this in view thick films were taken and examined on consecutive nights, but no microfilariæ were found. Negativing this proposition, also, is the fact that filariasis is undoubtedly uncommon in Perak; further, there was no rise of temperature or severe constitutional disturbance, as one would expect in attacks of elephantoid fever.

(3) *The Application of some Irritant Drug.*—This was discussed, but as no drug that we were acquainted with would produce such a condition, and, moreover, the fact that the part affected remained in a state of chronic inflammation for a long period, tended to make us search for some other cause.

We had not sufficient justification to accuse case No. 1 of malingering, and were nonplussed as to the cause of his complaint and condition, since he showed no improvement under any treatment. He was accordingly invalided from the Service as being unfit for work. Case No. 2 was sent on sick leave to India. A third case presenting itself, with similar signs, again perplexed us, and tended to convince us that the complaint was infective in nature and not produced by artificial means, and it was not until the occurrence of case No. 4 that we ascertained that the condition was really artificial.

Case No. 1, a Sikh, came to hospital on March 27th, 1907, suffering from an abrasion on the dorsum of his left forearm, said to have been caused by contact with a gun-wheel. This was treated on ordinary principles, but after a few days the whole hand and forearm were found to be intensely œdematous and reddened. This erythema gradually gave place to vesiculation and the formation of pustules, accompanied by much local heat. Within a week the whole hand and forearm were greatly swollen, brawny and indurated. After some considerable time the original wound completely healed, but the induration and œdema remained until he was invalided from the Service on June 25th, 1907. He was subsequently seen by a dresser, who stated that, although all the above signs had disappeared, some weakness of the limb remained.

Unfortunately, the case could not be followed further owing to his death from intercurrent disease.

Case No. 2, also a Sikh, was admitted into hospital on February 12th, 1907, suffering from an abrasion on the right foot, said to have been caused by a fall whilst playing football. He was discharged on February 28th, 1907, well. One month later he was readmitted suffering from solid œdema of the same foot. He was kept in hospital for one month, and as no improvement took place, was sent to India on sick leave. Six months later he returned and performed his duties for three days. He then attended hospital, as the œdema was again becoming manifest. This increased, and he was admitted into hospital a third time, where he still remains. His leg was encased in Unna's paste, the upper part showing considerable improvement. On removal of the paste, however, the leg resumed its condition of brawny induration.

Case No. 3, a Sikh, attended amongst the out-patients on July 11th, 1907, suffering from an abrasion on the dorsum of the left hand and wrist, said to have been caused by a fall. About ten days later, swelling of the forearm and hand began to develop. This swelling, as in case No. 1, was accompanied by local heat and redness, with gradually increasing induration. This continued, in spite of all treatment, until about the beginning of November, when we received information leading us to believe that this condition was caused by an irritant drug. From this time, although no treatment was adopted, improvement set in, so that he was able to return to duty by the middle of December. At the present time he shows no trace of his previous complaint.

Case No. 4, a Sikh, was admitted into hospital on November 2nd, 1907, presenting marked œdema and redness of the left forearm with large pemphigus-like blebs. This man was, owing to some disagreement with a comrade, accused by him of applying some irritant drug and so causing his condition, the result of this being that the whole hand and forearm speedily improved. As in the former case, this tended to support the idea that the disease was artificially caused. He is now in perfect health.

Case No. 5, a Punjabi Mahomedan, was brought to hospital on October 23rd, 1907, with a lacerated wound on the right palm and abrasions on the left hand, caused by a premature explosion of a gun. He was discharged from hospital on November 8th, 1907, having nothing more than slight stiffness of his right hand. On December 2nd, 1907, he was readmitted, presenting the following extraordinary signs: the whole of his scalp, face, arms and trunk as far as the umbilicus were acutely inflamed, swollen, and covered with an erythematous rash. In addition to this there was congestion of the conjunctivæ with chemosis. On auscultating his chest numerous rhonchi were heard; his temperature was 100·4° F.; his urine showed no albumin. He was accused of

having caused this condition by means of marking-nut fumigation, which, however, he stoutly denied. Shortly after admission, blebs appeared on the hands and forearms; but without any treatment the whole condition subsided within a week, undergoing resolution with exfoliation of the skin.

Case No. 6 was an experimental one. One of the hospital orderlies volunteered the information that he had previously seen, whilst working on a sugar estate, a similar condition artificially induced by indentured coolies for the purpose of malingering. The procedure had been as follows: the marking-nuts above mentioned were bruised and then placed on glowing charcoal in a brazier. A limb was then exposed for some twenty minutes to the fumes which arose, by which means the appearances above described were produced; a blanket was thrown over the limb and the brazier to concentrate the action. In order to prove the veracity of his statement the man offered to try the experiment himself. This was carried out in our presence. Accordingly, some marking-nuts were procured from the bazaar and bruised in a mortar. The fumes were produced by placing them on burning charcoal in a kerosene oil tin. The orderly's right hand and forearm were held about one foot above the fire and the limb and apparatus entirely covered with a blanket. At the end of ten minutes the limb, on being examined, showed no signs of abnormality whatever, but according to his statement it was numb. For the next few days he was carefully watched, and much disappointment was felt that no signs of the condition hoped for appeared. However, one week from the date of the experiment, œdema began to appear in the forearm, and by the tenth day both hand and forearm showed local heat, œdema and marked redness. No treatment was adopted, and at the end of another week, desquamation having occurred, the limb resumed its normal appearance.

Case No. 7.—To try the local effects, one of us, F. E. W., applied the expressed oil over an area the size of a threepenny piece to the flexor surface of the left forearm. In a few hours there was considerable irritation, and this was followed by a blister. A few days later there was intense irritation with the formation of an areola of secondary vesicles; the forearm continued to swell, and in one week from the application it presented the following appearance—the whole forearm was swollen, red and intensely inflamed, the limb was extremely painful, but no enlargement of the lymphatic glands was present. Desquamation of the limb followed, with gradual return to its normal condition.

Concerning *S. anacardium*, the following extracts have been taken from the *Materia Medica* of Madras, vol. i., 1891, by Mohideen Sheriff Khan Bahadur.

"*Synonyms.*—Marking-nut (Hind., *Bhilavan*).

"*Physiological Actions.*—Internally, sedative, antispasmodic, nervine and alterative tonic; externally, stimulant, rubefacient and vesicant.

"*Therapeutic Uses.*—Externally, the oil is a cheap and useful counter-irritant, but requires great care and caution in its employment. The nut is more useful in hæmorrhoids in the form of fumigation than the internal administration of its oil or electuary; but, unfortunately, its smoke is attended with bad effects on some constitutions. Out of the two severe and painful cases of piles I treated with fumigation, one suffered from œdema of the face, chest and abdomen, with an erysipelatous blush, while the other was quite free from all these symptoms. The persons engaged in removing the kernel frequently suffer from a swelling on the arms, face and legs. The swelling of the face is generally accompanied by an erysipelatous blush, and that of the extremities by a miliary eruption. In some severe cases the swelling lasts for more than eight or ten days, and terminates by desquamation of the cuticle.

"*Remarks.*—On breaking the nut, the pericarp will be found to contain an oily juice, which is very black, of a thicker consistence than honey, viscid, and leaving a permanent black mark on cotton cloths. Owing to its last-named character the juice is used for marking cotton cloths all over India, and the fruit producing it is therefore called in English the marking-nut."

Some Points of Interest.—One of the chief points brought out by our experiment was the prolonged interval between the act of fumigation with the drug and the development of the toxic signs. For instance, had we isolated cases Nos. 1 and 3, we may suppose that the results would still have followed in spite of the strictest observation, thereby making the detection of a malingerer extremely difficult. Another point, not without significance, was the fact that in no less than three of the cases the left arm was the part involved, and this for the obvious reason that the right arm was used for carrying out the process of fumigation.

INTRAPERITONEAL RUPTURE OF AN ABNORMAL BLADDER.—OPERATION.—RECOVERY.

By Major C. B. LAWSON.
Royal Army Medical Corps.

At 9.15 on Christmas morning, 1906, I received a message from Captain Ryan, R.A.M.C., to the effect that a case (No. 7573 Gunner E. D., 65th Company Royal Garrison Artillery) which would probably require immediate operative treatment had been brought to the Military Hospital, Valletta. I arrived at the hospital about 9.30 a.m., where I met Lieutenant-Colonel Jennings, R.A.M.C. (the officer in charge of the hospital), who had already seen the patient and considered his condition grave. Captain Ryan, R.A.M.C., gave the following history of the case:—

The patient had, at about 9 a.m. that morning, tried to raise above his head a heavy bar dumb-bell[1] and which had fallen on his abdomen. He was brought to the Medical Inspection Room, St. Elmo, supported by

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[1] Found afterwards to weigh 95 lb.

two men. On admission he was collapsed, almost pulseless, and had an agonised expression. Captain Ryan had him placed on a bed, sent for a stretcher party, and administered liquor strychninæ hydrochlorid., ♏iii., hypodermically, and shortly afterwards accompanied him to hospital. The patient wished to go to the latrine but was not allowed to do so. He was placed in bed as soon as possible and steps were taken to relieve shock, the dose of strychnine being repeated. The patient shortly after being put to bed stated that he wished to pass urine, but on getting the bed-urinal he was unable to do so. A No. 8 silver catheter was then passed and about an ounce and a half of blood-stained fluid drawn off.

When I first saw the case he was lying in a bed in the Special Surgical Ward and gave me the impression of a man who had recently been drunk; his breath smelt of alcohol and his speech was at times incoherent; his pulse was good, and he had, apparently, recovered from the primary shock; his colour was fairly good and his facial aspect not pathognomonic. Both lower extremities were extended. He said he had passed urine about half an hour before the accident. A rapid physical examination showed his abdomen to be perfectly motionless and rigid, the epigastric region being tender; he was quite positive he had been struck in the epigastrium. Captain Ryan had found nothing abnormal in the rectum, which, however, contained some fæcal masses. I gave directions that the patient should be given a simple enema and that the abdomen and pubes should be shaved and washed with soap and warm water.

At 11 a.m. the patient appeared greatly improved and was again examined, this time in consultation with Colonel Jennings, Majors Pollock and Williams and Captain Ryan. He was now found lying on his right side; his abdomen was not rigid but moved with respiration; the right side of the abdomen, to within 1 inch of the middle line, was dull on percussion. On gently turning the patient on his left side the conditions were, after a short time, reversed, almost the whole of the left side of the abdomen becoming dull. Captain Ryan again passed a silver No. 8 catheter and drew off about 5 ounces of deeply blood-stained fluid, which came out with considerable force; this was somewhat against the probability of the bladder being ruptured, but nevertheless the abdominal condition and the history made an exploration justifiable. With the exception of an attack of gonorrhœa in 1903, which lasted about a month, there was no previous history of disease of the genito-urinary system.

At 12.30 p.m., the patient having been duly prepared, Lieutenant Lloyd Jones, R.A.M.C., commenced to administer the anæsthetic, which consisted of a mixture of chloroform and ether in the proportion of 2 : 3. When sufficiently unconscious Colonel Jennings passed a No. 10 silver catheter, and 6 ounces of warm sterilised boric lotion were run (pre-

sumably) into the bladder, through a funnel and tube. Immediately on lowering the funnel, 5½ ounces of blood-stained fluid were withdrawn; the missing half ounce being accounted for by the amount remaining in the tube and catheter. This condition of things was rather disconcerting; but Colonel Jennings now made the important observation that on moving the catheter about, while the fluid was running in, he had a sensation as if the end of the instrument passed over something like a knuckle of intestine. The idea at once struck me that there might be a rupture of the bladder plugged with gut.

Assisted by Major Pollock, I commenced the operation by an incision from the umbilicus to 3 inches below it and slightly to the right of the middle line. As some difficulty was experienced in entering the abdominal cavity, I extended the incision 2½ inches downwards and found a sausage-shaped mass occupying the floor of the wound. The only explanation of this mass appeared to be that we were dealing with a partially obliterated urachus, and on this supposition I transferred my attention to the upper angle of the wound. The peritoneum was, with some difficulty, defined and cautiously opened (after all hæmorrhage had been quite arrested). Blood-stained fluid was next looked for and soon found. The peritoneum having been freely incised, a portion of colon was identified, and on gently drawing on this it came away from below the sausage-shaped structure, pulling up with it two ragged edges, which were found to be those of a rupture of the bladder.

The patient was then placed in the Trendelenburg position and the intestines guarded with an abdominal cloth. The supposition as to the nature of the sausage-like body was found to be correct, a hollow urachus, extending to within 2 inches of the umbilicus, being now clearly exposed. The rupture, which was about 3 inches in length, occupied the entire length of the posterior aspect of the urachus and ran on to the roof of the bladder, which was of the infantile type. The lower part of the rupture deviated to the left and was very ragged. The interior of the bladder was carefully examined to ascertain whether there were any more tears, but none was found. The rent was now closed by medium-sized catgut sutures passed interruptedly Lembert-wise through the muscular and submucous coats. The parts were thus held well together and facilitated further and more efficient suturing, which was performed by making a second row of interrupted Lembert sutures (this time of silk) also through the muscular and submucous coats. On tying these the catgut sutures were buried. Finally the peritoneal coat was accurately brought together by fine silk Lembert sutures, which were interrupted in the lower half of the wound, but continuous in the upper.

While still in the Trendelenburg position the irrigation of the abdominal cavity with normal saline solution was commenced, and when the fluid returned perfectly clear, the patient was lowered into the horizontal

and the irrigation continued. Towards the end of the peritoneal toilet, the bladder was seen to be gradually distending and assuming a gourd-like shape with the urachus for its narrow part. To avoid tension a French olivary No. 8 catheter was passed and left in. The abdominal wound was closed by a continuous silk suture for the peritoneum, silk-worm gut for the fascia transversalis, rectus muscle and skin, with here and there horsehair, to more accurately close the skin incision. A small rubber drainage tube was inserted in the prevesical area and brought out at the lower part of the wound. Double cyanide gauze wrung out of 1—2,000 biniodide of mercury lotion was applied over the wound, this was covered by several layers of dry double cyanide gauze and a pad of double cyanide wool, and the whole fixed by a many-tailed flannel bandage.

The patient stood the operation well; 3 minims of liq. strych. hydrochlor. were given twice during its performance to obviate shock. The catheter was tied in, and the patient was placed in bed with his shoulders and thighs raised. He soon came out of the anæsthetic.

At 10 p.m. he was, with the exception of a slight headache and thirst, fairly comfortable; he had not vomited, a point of great importance, and largely due to the skilful way in which the anæsthetic had been administered. A sterilised rubber tube was tied on to the catheter and led into an empty bottle, in the neck of which it was fixed with some sterilised double cyanide and wool. A teaspoonful of water was administered occasionally.

On January 5th, 1907, catheterisation was discontinued. The silk-worm gut and horsehair stitches were removed, primary union having occurred. The drainage-tube aperture had almost closed. The patient felt comfortable. Urotropine continued. Urine normal. Amount of urine passed in the last twenty-four hours was 36 ounces. Pulse 66 M., 72 E. Temperature normal.

On February 6th, the administration of urotropine was stopped. This drug had been given since the operation, at first thrice, and later once daily.

On February 28th patient was discharged cured.

March 25th, 1908.—Fifteen months have elapsed since the injury, and from January 7, 1907, he has complained of no urinary symptoms. He is now quite well and has been at duty for over a year.

Points of Special Interest.

(1) Difficulty in diagnosis, the usual signs and symptoms of the injury being almost entirely absent, *i.e.*, there was no burning sensation in the hypogastric region, no constant desire to urinate, the fluid test was negative, there was no severe shock, and the bladder was not found empty at the second passing of the catheter.

(2) Detection of a knuckle of intestine in the bladder by means of the catheter.

(3) The presence of a partially obliterated urachus reaching to within 2 inches of the umbilicus, with a corresponding high reflection of the peritoneum.

(4) The favourable result, considering that the condition is a very fatal one. Treves, in his "Surgical Applied Anatomy," latest edition, states that only five cases out of seventy-eight have recovered.

NIGHT URINALS.

By Colonel W. J. R. RAINSFORD, C.I.E.
Army Medical Service.

It is unnecessary to dilate upon the filthiness attending the use of urine tubs in barracks, especially in two-storied buildings, where these tubs have to be carried up and down stairs: the saturated condition of the floor in the vicinity of the urine tub, the result of carelessness, drunkenness, or want of light, to say nothing of the danger of propagation of disease. We have in Bermuda recently detected both tubercle bacillus and *Bacillus typhosus* in the urine of men in other respects apparently fit for duty.

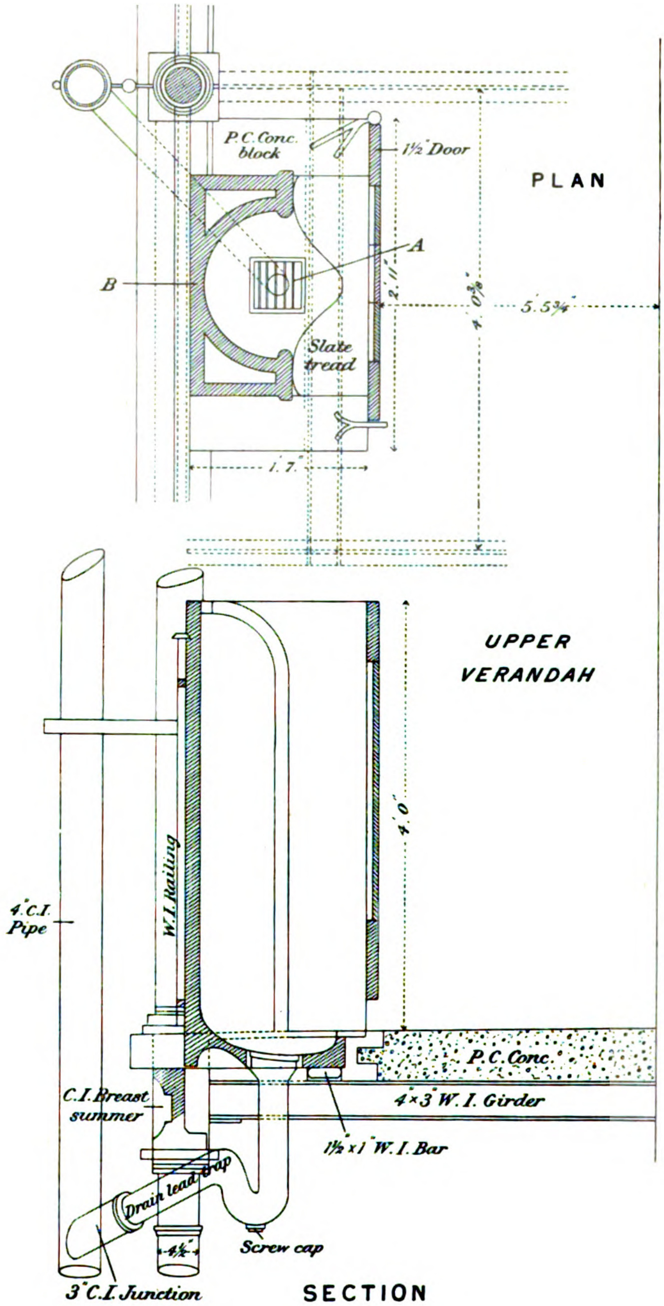
Two night urinals are now on trial at the Prospect Barracks, Bermuda. Their use was suggested by Major S. St.D. Green, R.A.M.C., and were designed by myself and the Commanding Royal Engineer.

The advantages claimed for them are: (1) Even a half-drunken man when using them would find it difficult to wet the adjacent floor; (2) their position ensures perfect ventilation; (3) their size being small they do not block up the verandah, and on that account are not unsightly; (4) as they are kept locked up from "reveille" to "last post," or after dark at night, their exposed position does not matter as regards modesty.

Water is not laid on in these barracks. A bucket of water and a mop are used for cleansing them every morning. The mop is or can be kept in the urinal during the day.

It will be seen from the plan accompanying this note, that the glazed urinal of ordinary pattern is supported on either side by concrete walls, from which the door is hung.

Should similar urinals be extensively adopted, it appears to me that a special pattern urinal, with the sides extended and fitted with spurs, and a staple to hang and lock the door, would make perfect a urinal that has proved after a year's test a very great success.



A, Gun-metal grating and connection to be fitted with lock and key; *B*, glazed stoneware urinal. No flush pipe required.

The shading indicates concrete support from which the door is hung and secured.

SOME SUGGESTIONS FOR DENTAL SURGERY ON ACTIVE SERVICE.

By Major B. W. LONGHURST.
Royal Army Medical Corps.

Many letters have been written and many suggestions made for the efficient dental treatment of British troops, but these new schemes do not deal with the all-important question of active service.

How can dental surgery be carried out on active service? and what equipment should be carried? are the questions I will now endeavour to answer.

A dental surgeon who has never been on active service or one who has never been farther than the base hospital, is not likely to appreciate the difficulties on the line of march, nor the impossibility of finding transport for the equipment he would require at a stationary hospital. In dealing with this subject it appears best to start with a description of the work which can be carried out at a base hospital and the necessary outfit required, and then to describe the work which could be easily managed on the line of march and what equipment should be carried to perform it.

Base or Stationary Hospital.—At a base or stationary hospital, of course, ordinary amalgam and osteo-plastic fillings could be made, and exposed nerves treated effectually, but to do this the following equipment would be necessary: One S.S. White portable dental chair, packs in box 39 inches long, 13 inches wide, 7½ inches deep, and with the chair packed for transportation weighs 88½ lbs.; one student's dental cabinet, which contains all the filling instruments, appliances and fillings necessary, and measures 12 inches long, 9 inches wide and 10 inches deep; one S.S. White dental engine packed in case 35 inches long, 15 inches wide, and 5 inches deep.

Field Hospital.—In a field hospital, or combined unit, temporary fillings could be done in camp and exposed nerves treated without extraction as a temporary measure, but the following equipment would be necessary for this: A small case of hand instruments 2 inches wide, 8 inches long and 2 inches deep, or a leather pouch 8 inches long and 8 inches in circumference; a few small bottles containing osteo-plastic fillings, gutta-percha, oil of cloves, pulp spot or pulp chamber paste, for the immediate treatment of exposed nerves.

Line of March.—On the line of march very little conservative dentistry can be done, but something more than extraction of teeth can be carried out. A dressing of oil of cloves made into a paste with acetate of morphia can be inserted into the cavity of a decayed and aching tooth and kept *in situ* with a small piece of cotton wool dipped in gum mastic or gum sandarac, which will set hard and last for a month or more. Pulp spot or

pulp chamber paste can be applied direct to an exposed nerve and a piece of gutta percha placed over it, which may alleviate the pain altogether. To arrest pain and put in a temporary filling or dressing, the following instruments only would be required, and take up very little space in the medical pannier: Two excavators, one pair of tweezers and a small mirror. The tweezers and mirror are already contained in the tooth pouch supplied, and there are only the two excavators to add, which would not increase the size of the case, as they take up no more room than two probes. To put in a gutta percha filling a plugger, in addition, would be required; there is already a spirit lamp in the medical pannier for the field sterilizer, so very few extra appliances need be carried. I would suggest the following drugs as most useful and most easily used on the line of march: Acetate of morphia made into a paste with oil of cloves as an obtundent to relieve pain at once, cotton wool dipped in gum mastic, as the filling, to be placed on the top of this.

With regard to extraction, this can be carried out anywhere, under fire if necessary, and the pouch of tooth forceps supplied is sufficient for everything; but I would suggest that a medical officer in charge of cavalry be supplied with a single pair of "bayonet-shaped" upper stump forceps, to carry in his haversack, as with these he could, in case of emergency, remove any tooth in either upper or lower jaw with the patient lying down. These I found most useful and quite sufficient for all cases of emergency; the pouch of tooth instruments can thus be dispensed with for the time being and left behind in the pannier with the transport. It is quite necessary for the medical officer with the advance guard to have a pair of forceps such as I have described, carried in his own haversack or in the saddle-bags carried by his orderly; he may be five or six miles away from his panniers, cut off from the transport and rear guard at any moment, and remain without access to his panniers for perhaps days.

THE TREATMENT OF SCABIES BY BALSAM OF PERU.

By Lieutenant W. G. AVISS.
Royal Army Medical Corps.

The use of balsam of Peru in the treatment of scabies is frequently urged in the columns of the Journal. It certainly cures the scabies, but in many cases the results of the application are much worse, for the patient, than itch. I have recently had under my observation three cases, not without interest.

One, after one application of the balsam, developed an intense erythema, followed by desquamation, albuminuria (no blood), and general œdema. It was not a case of scarlet fever, and is still in hospital.

The other two cases developed an acute eczema with much pustular exudation affecting the whole body, likewise after only one application of the balsam. They each spent about six weeks in hospital while their eczema was getting well. In view of these facts I have returned to the old and cheap soft soap, scrubbing brush and sulphur ointment treatment, which is, to my mind, just as efficacious as the balsam method.

Eczema, which costs 2s. to produce, and leads to six weeks in hospital, is, I think, to be avoided if possible. I agree that the balsam is good for early ringworm. For old cases I have not found it any better than the ordinary methods of treatment.

A SIMPLE METHOD OF OBTAINING CLEAR AGAR AND GELATINE MEDIA WITHOUT THE USE OF THE HOT WATER FUNNEL.

By Serjeant E. B. DEWBERRY.
Royal Army Medical Corps.

Great difficulty and considerable inconvenience is often experienced in the filtering of agar and gelatine media. The following simple contrivance will, I think, overcome the difficulty, and probably be quite as efficient as the hot water funnel method.

A small perforated circular disc of porcelain, about $\frac{1}{4}$ of an inch thick, is procured, the edge of which is ground to fit about half way down the inside of a plain funnel. The disc is placed in the funnel, and covered with a thin layer of white absorbent cotton wool. Boiling water is then run through, and the apparatus is ready to receive the media.

Report.

REVIEW OF THE PROGRESS OF HYGIENE IN 1907.

By Lieutenant-Colonel A. M. DAVIES.
Royal Army Medical Corps.

(*Continued from page* 546.)

III.—Food and Dieting.

Protein Requirements.—In continuation of the former notice of Professor Chittenden's work on "Physiological Economy in Nutrition" and the criticism which it gave rise to (see this Journal, April, 1907), some allusion must here be made to this author's book entitled "The Nutrition of Man," published in 1907. The scope of this is much the same as that of the former book noticed last year. One of the criticisms directed against Chittenden's low protein diet was based on the injurious effects stated to have been produced in animals fed on this principle. As regards carnivora, Munk, Rosenheim and Jagerroos had stated that a low protein diet resulted in loss of absorptive power in the intestinal tract, due apparently to change in the epithelial cells, and diminished secretion of digestive fluids. Chittenden now examines this criticism and the experimental evidence on which it was based. In regard to the two dogs that were the subject of Jagerroos's experiment, he shows that Jagerroos himself did not attribute their death to the deficiency of protein, but to the results of infection. They both died suddenly. Both *Bacillus coli communis* and a streptococcus were found in the blood. There was no pathological alteration or fatty degeneration of the intestinal epithelium. Chittenden believes that, in regard to the other dogs, it was monotony of diet and confinement that led to their loss of health. Accordingly, he has carried out experiments on twenty dogs; the results of six of these experiments are ready, and are detailed in his new volume. The dogs are fed twice daily on a mixed diet, and are kept in a large, airy room, exercise being allowed except for ten days in each month, when they are confined to a "metabolism cage" to determine the nitrogen balance. Full details are given of the dietaries and management of the animals, the experiments lasting over a year or thereabouts; photographs of the dogs are given which entirely bear out the correctness of the author's contention, expressed as follows: "These experiments on the influence of a low proteid on dogs, as a type of high proteid consumers, taken in their entirety, afford convincing proof that such animals can live and thrive on amounts of proteid and non-nitrogenous food far below the standard set by Munk and Rosenheim. The deleterious results reported by these investigators were not due to the effects of low proteid or to diminished

consumption of non-nitrogenous foods, but are to be ascribed mainly to unhygienic conditions, or to a lack of care and physiological good sense in the prescription of a narrow dietary not suited to the habits and needs of this class of animals. . . . The more or less broad deductions drawn from the experiments of Munk and Rosenheim, especially in their application to mankind, are entirely unwarranted." It must be admitted that Chittenden has legitimately scored a point here; it remains to be seen if the observations of Shutt and of Skinner on hogs, and of Haecker on cows, can be similiarly disposed of.

Chittenden relates some dietary experiments by Professor Irving Fisher, of Yale university, on nine students. (Professor Fisher has since published these in detail himself, 1907.) These students, who were all in perfect health, desired to try on themselves the effects of diminution of protein in the dietary, together with thorough mastication, as advocated by Mr. Horace Fletcher. The experiment lasted for five months. At the beginning the average calories of the daily dietaries amounted to 2,830, of which 210 were derived from flesh food; the calories from proteid were 1·4 per lb. body-weight. The men were all working and studying hard; there was a slight loss of average total strength, but the endurance increased remarkably in all (except one man, whose reduction in quantity of food, in protein, and in flesh food was less than any one else's), showing an average increase of 140 per cent. ("The Effect of Diet on Endurance," by Irving Fisher, 1907).

Chittenden also quotes the case of Dr. Neumann, of Kiel, who lived for twenty months on a low protein dietary of 66 to 76 grammes, with either constancy or slight increase of body weight, the total calorie value of the diet being from 2000 to 2300; the amount of protein varied between 0·99 and 1·00 gramme per kilogramme body weight.

Allusion is made to a suggestive article by Dr. Herter, on the Character of the Bacterial Flora of Carnivorous and Herbivorous Animals (*Science*, December, 1906). This author has reported the presence in the intestines of the cat, dog, tiger, lion and wolf, of many spore-bearing bacilli, as well as free spores and vegetative forms of anaërobic organisms; some of which are markedly pathogenic when injected into the subcutaneous connective tissue. With herbivorous animals, on the other hand, such as the goat, buffalo, horse, elephant, &c, the predominating organisms are of a different order from those found in the intestines of carnivora, being practically non-pathogenic, or only slightly so, when injected subcutaneously, and less disposed to produce putrefactive changes or other chemical decompositions. It is easy to imagine that a predominance of animal or of vegetable food may materially modify the bacterial conditions of the intestinal tract in man; and there can be little doubt that from the bacterial, as well as from the chemical, point of view, excess in animal food and excess in the protein constituents are likely to be deleterious.

Enteric Fever due to Oysters.—To the well-known outbreaks that have occurred in Britain and America may now be added an extensive epidemic in France, enquired into by Professor Netter, and traced to consumption of oysters from Cette (*Revue d'Hygiene*, May, 1907). A total of 262 cases of illness was reported, of which sixty-three were enteric fever; at Cette the oysters was taken from the Etang de Thau, and placed in the canals of the town, in order to fatten; these canals receive sewage; enteric had existed in the town. A. Gautié found in the oyster juice 15,000 to 70,000 germs in the Cette oysters; in those from Marennes only 300 to 5,600; *B. coli* was found nine times out of ten in the Cette oysters, once only out of ten trials in those from Marennes.

Clams may now be added to the list of shell fish that have caused enteric outbreak.

Food Poisoning.—Several outbreaks of food poisoning have been recently recorded, in which the paratyphoid bacillus, type B, has been isolated, either from the food suspected, or from the bodies of the persons affected, or from both. The severity of the symptoms varies greatly. At Greifswald (1904), fifty soldiers were attacked with diarrhœa, vomiting, cramps and fever, lasting eight to twelve days; no death resulted. The food suspected was beef that to all appearances was sound; paratyphoid B was found in the stools, virulent to guinea-pigs (*Bulletin Pasteur*, 1907, 526). In Berlin (1906) ninety persons were attacked with diarrhœa and vomiting, either choleriform or dysenteric; three deaths occurred. The symptoms were due to beef, eaten uncooked; when cooked, no ill effects were produced. Paratyphoid B was recovered from the stools and (in three cases) urine of patients, very virulent to guinea pigs, even when the cultures were boiled (Jacobson, *Berlin. klin. Wochens.*, 1907). Fromme, of Gottingen, reports thirty-two cases of diarrhœa, vomiting, &c., some mild, others serious, and accompanied by hæmorrhagic nephritis, but none fatal, due to raw pork minced; the meat on examination showed presence of a layer of pus next the bone: in this pus, and in animals inoculated with it, was found paratyphoid B, proved to be virulent to animals (*C. f. Bakt.*, Orig., 1907). Krehl, Kayser and Cahn, of Strassburg, report seven cases of sausage poisoning (colic, diarrhœa and fever lasting some days); one case developed remittent fever of eighteen days duration, with diarrhœa and enlarged spleen, but no rose spots. Nothing suspicious was detected in the sausages, but paratyphoid B was found in the stools of all the cases (*Deutsche med. Wochens.*, 1906). At Tempelhoff, Berlin, twenty-four hours after eating a cake made of semolina, milk, vanilla and duck's eggs, seven persons were taken ill with choleraic symptoms; one case was fatal. Paratyphoid B was isolated from the stools and vomit, and from the organs of the fatal case, very virulent to guinea pigs, and retaining its toxicity after sterilisation in the autoclave. Vagedes considers that infection was due to the ducks' eggs, in which he had frequently found

numerous germs, though not previously the paratyphoid bacillus (*Klin. Jahrbuch*, xiv.). Netter and Ribaudeau-Dumas report seven persons attacked with choleraic symptoms after eating a galantine; paratyphoid B was found in the urine and stools (*C. R. Soc. Biol.*, 1907). At Leipzig 250 persons were attacked with colic, diarrhœa, shiverings, &c., some hours after eating a *conserve* of French beans, in which were found *B. coli* and paratyphoid B; the cultures were harmless to guinea-pigs by the mouth, but toxic by injection even after fifteen minutes boiling (Rolly, *Münch. med. Wochens.*, 1906). Kutscher reports ninety cases of severe food poisoning in Berlin, with high fever, vomiting, cramps and diarrhœa; two deaths occurred. Paratyphoid B was isolated from the suspected meat and from the stools. Kutscher states that the absorption of a large quantity of the microbes causes cholera nostras; if they are less numerous the symptoms are those of typhoid (*Berlin. Militarartz. Gesellschaft*, 1907). At Hesse seven persons partook of cooked pork that was apparently sound; diarrhœa resulted, and from the stools was isolated (besides *B. proteus*) Gaertner's *B. enteritidis*, virulent to mice. Also, twenty-two persons were taken ill, five or six hours after having eaten a pudding, with diarrhœa and fever; one death occurred; from the cream of the pudding, Curschmann isolated Gaertner's *B. enteritidis* (*Z. f. H.*, 1906).

The above instances of food poisoning have been found to be connected with either the paratyphoid bacillus, type B; or Gaertner's *B. enteritidis*. The term *Salmonelloses* has been proposed by Lignières, of Buenos Ayres (1900) as applicable to the group of microbes presenting morphological and cultural characters resembling those described by Salmon and Theobald Smith in 1886, for the organism that causes *hog cholera*. Sacquépée (*Bulletin Pasteur*, November, 1907) divides this group of organisms into two sub-groups, chiefly on account of their agglutination characters: in the first sub-group are Gaertner's bacillus and the meat bacilli of the Gaertner type (those of the poisoning outbreaks at Morseele, Brussels, &c.); the bacillus of Thomassen and the Danysz virus. The serum specific for any one of these organisms agglutinates with any other of the sub-group in practically equal degree, but does not agglutinate (or but rarely) with the other *Salmonelloses;* nor are the organisms of this first sub-group agglutinated by the specific serums of the other. The members of this second sub-group do not behave so uniformly in regard to their agglutinating characteristics as those of sub-group 1; but they show an obviously close relationship *inter se*; in this sub-group are included the bacilli of hog cholera, of psittacosis, of mouse typhoid, the paratyphoid bacillus B, and the meat bacilli of the Aertrycke type. The whole group of "Salmonelloses" present a homogeneous assemblage in regard to morphology, cultural characters and biological properties; also in regard to their pathogenic action and the lesions they produce; by their agglutinating reactions and the bactericidal

properties of their serums, they are divided into the compact sub-group of the Gaertner type, and the larger sub-group comprising the hog cholera and paratyphoid bacillus B, &c. Sacquépée calls attention to the possible significance of this near relationship, subsisting between bacteria such as paratyphoid bacillus and those of meat poisoning cases—which are known to be pathogenic to man—and the hog cholera and mouse typhoid bacilli, which have hitherto been considered innocuous.

Improvement in Milk Supplies.—Efforts are now being made in many parts of the country to some purpose, in the direction of securing a clean and wholesome milk supply. An important case was decided at the Tower Bridge Police Court, May 12th, 1905, on the prosecution of the St. Pancras Borough Council, the result of which cannot be too widely known. The milk supplied by the defendant, a farmer, who contracted to furnish pure milk to a firm of wholesale milk distributors, was shown to be obviously dirty milk on naked-eye inspection: it was condemned as unfit for food. The defendant was fined £25 and £5 5s. costs. On further examination the milk was found to contain fæcal matter, pus cells and tubercle bacilli. Dr. Collingridge remarks that "the case is notable as being the first of its kind with regard to milk, and should have a good effect in awakening farmers to a sense of their responsibilities, and the importance of cleanliness in handling milk" (*British Medical Journal*, March 30th and April 20th, 1907).

A street milk vendor in Westminster was sentenced to six month's imprisonment with hard labour (October 16th, 1907), for selling milk that was unwholesome and unfit for food. The milk was being hawked about in a churn and hand-can. It smelt offensively, and at the bottom of the can was found a large quantity of filthy material, consisting of vegetable *débris*, hairs (human and other), pieces of human skin, tomato skins, and other objectionable matter, apparently coming from a dirty stable, or from the street.

It is evidently the duty of all authorities concerned to exercise careful watch over the condition of the milk that is supplied, and to act vigorously on the lines above indicated, when the impurity is such as has been mentioned. Houston's method of estimating the volume of "apparent filth" in milk, and microscopical examination of the deposit, may be carried out with advantage (see his Report on Bacteriological Examination of Milk, London County Council Reports, No. 933, 1906). Dr. Forman, Chairman of the Public Health Committee of the London County Council, in presenting a report on "Proposals for Legislation in 1908," stated (July 9th, 1907) that the most urgent need was to secure for the inhabitants of London an uncontaminated milk supply: special legislation was not sought for, as the President of the Local Government Board was bringing in a Bill dealing with the matter for the whole country.

A joint committee has been formed, representative of the County Councils of the West and East Ridings of Yorkshire, of the Yorkshire

Council for Agricultural Education, and of the leading County Boroughs, to carry out investigations as to the contaminating influences at work on milk, throughout its progress from the cow to the consumer. The samples are being taken by arrangement with the farmers and milk dealers in each case. Bacteriological examinations are being made; and the report of the investigation, which is being conducted in a most thorough manner, will be awaited with interest.

The question of a pure milk supply has also been taken up by the authorities of the principal London Children's Hospitals, who at a representative meeting on April 26th, 1907, passed a series of resolutions requiring that the supply should be pure and genuine; from healthy cows; strained, refrigerated, canned and sealed at the farm; not "Pasteurised" without sanction of the hospital authorities; tested once a week chemically and bacteriologically; and that the farms whence the milk is supplied should be notified, and inspected from time to time.

As an instance of what can be effected by cleanliness, Hempel relates that milk obtained under aseptic conditions from a model dairy near Dresden, can be sent to Bremen (more than 300 miles distant) without ice during the summer, and has afterwards been found to be sweet after crossing the ocean in an ice-box (*Münch. med. Wochens.*, liii., 7).

In New York City a conference on the "Milk Question" was called together in November, 1906. The chief points that were laid down as agreed upon, and necessarily to be carried out, were: That cleanliness is the supreme requisite, from cow to consumer, viz., in all persons concerned, premises, water, utensils, cans and bottles; temperature is the second essential, viz., 50° F., or lower, at the dairy, 43° at the creamery, 45° or less during transportation, not above 50° when delivered; Pasteurisation is not necessary; inspection is required. A system of marks, or "points," has been devised, relating to the cows, stables, milkhouse, milking process, and handling of the milk; out of the total 100 score, a dairy reaching 90 is considered excellent, 80 good, 70 fair, and any below 70 is regarded as "poor."

In opening a discussion on infant mortality and milk supply at the British Medical Association Meeting in July, 1907, Professor Kenwood urged the necessity for veterinary inspection of milch cows (especially for tuberculosis), and for an annual licensing of all premises where milk is sold or collected; this licence depending, of course, on a satisfactory inspection. He thought that the danger for prolonged use of sterilised milk had been much exaggerated, in which opinion the present writer most heartily concurs. The dangers to health of raw milk as at present usually supplied are overwhelmingly greater than the risk of infantile scurvy from sterilised or Pasteurised milk. This risk can only exist in the case of infants, whose diet would be confined to milk, as the only article of food consumed, and may be obviated by appropriate measures.

Dr. W. Collingridge, Medical Officer to the Corporation of London, in

his report, March, 1907, has sounded a note of warning in regard to the opinion that the milk of tuberculous cows is not dangerous unless the udder is affected with the disease. He points out that, though the proportion of cows so affected in this country is only about 2 per cent. (the risk therefore appearing to be small), there are other indirect ways of spreading contamination; the dust of cowsheds in which tuberculous animals are kept must become infected, and this dust gains access to the milk. (Mr. James King, out of 500 carcases of cows examined by him in London, found that only 266, or 52·3 per cent., were entirely free from tuberculous disease.) Klein found tubercle bacilli in 3 out of 39 milk samples examined in 1904; in 2 out of 22 in 1905; and in 2 out of 25 samples in 1906. The risk ratio is certainly higher than 2 per cent. of the cow population.

Alcohol.—The cause of temperance suffers so much from injudicious advocacy, that it behoves all its supporters on scientific grounds to be careful to refrain from the least exaggeration. The evils of alcoholic excess are so obvious and so appalling, from whatever point of view they are considered, that there is not the slightest need to make them out to be greater than they really are; or to deny to alcohol any possible use under any circumstances whatever. The researches of Atwater and Benedict have for most students of the question sufficed to prove that alcohol is not only a poison, but is physiologically, under strictly limited conditions, a food as literally as is the albumen of egg or the sugar of milk. This is, however, frequently denied by the more strenuous advocates of total abstinence. It is to be noted, therefore, that at the Physiological Section of the British Association, in August, 1907, Professor Cushny stated that, "in respect to the food value of alcohol, experiments over many years had shown that over 95 per cent. ingested underwent combustion in the tissues, and was utilised by them as a source of energy for muscular strength and body heat. Alcohol was therein strictly comparable to sugar, which was also an alcohol, though of a more complex nature." But this by no means implied that alcohol was a suitable food either in health or in disease. Dr. Dixon stated, from his own experiments, that the presence of small quantities of alcohol in the blood, up to 0·2 per cent. increased the amount of work and the output of blood from the heart, especially when the heart was beating quickly or failing. The type of action was changed entirely when the amount was increased to 0·5 per cent.; the work of the heart was then not facilitated.

As to its effects under circumstances requiring great exertion, Dr. Schneider examined 1,200 mountain climbers, and found that, as long as continuous efforts and difficulties are to be expected, no alcohol should be taken. Only for a special effort of mind or body (as for overcoming a final obstacle) may a dose be advisable. In descending, when all difficulties have been overcome, many mountaineers find a small dose of brandy a restorative (*British Medical Journal*, August 24th, 1907.)

In regard to its causative relation to insanity, Dr. Mott considers that alcohol does not, *per se*, produce a permanent mental derangement, such as constitutes our definition of insanity. It does not, or ought not to, occupy the high place given it as a cause of insanity in the Lunacy Commission Reports (*British Medical Journal*, September 28th, 1907). Dr. G. H. Savage also, in his Lumleian lectures, points out that the consumption of alcohol has greatly decreased in recent years, and there has been a great increase in temperance, yet there has also been a fairly steady increase of insanity (*British Medical Journal*, March 30th, 1907). Professor Anderson, of Galway, has noted that the narcotic influence of alcohol, as lowering cerebral function, may produce a temporary rest from strain that is even beneficial, having its physiological counterpart in sleep. The discussion on alcohol and insanity in the Psychological Section of the British Medical Association, in 1907, certainly conveyed the impression that those specially qualified to judge do not consider alcohol as a poison, pure and simple.

IV.—Sewage Removal and Disposal.

Sewer Air and Intercepting Traps.—The very interesting and important experiments by Major Horrocks on the presence of specific bacteria in the air of drains and sewers have been fully detailed in this Journal (October, 1907), and need not be more than mentioned in this place. Dr. F. W. Andrewes has also found evidence of the presence of sewage organisms in sewer air by obtaining cultures of *Bacillus coli* and sewage streptococci on plates exposed in the sewer (Report to Hampstead Sanitary Authority, 1905, quoted in *Public Health*, July, 1907). Dr. Hurtley has pointed out that the air of sewers being always saturated, or nearly saturated with water vapour, if only a slight lowering of temperature occurs, condensation will take place on any floating particulate matter (*e.g.*, bacteria), and this will be deposited, and the sewer air consequently cleansed; this condensation occurs regularly at night. Some years ago Professor Tichborne, of Dublin, drew attention to the same condition of things, but looked at it from the opposite standpoint. He considered that sewage organisms were carried about, as on a raft, by the droplets of condensed vapour formed during the cold hours of the night, and dissipated when the air becomes warmed; thus leaving the imponderable microbe floating in the air, which might consequently be a medium for spreading specific disease.

An important discussion on certain suggested amendments to the Drainage By-laws of London took place at the Royal Sanitary Institute in May and October, 1907 (see *Journal Roy. San. Inst.*, July and November, 1907). Among the points considered was that of the retention of the intercepting trap; the meeting was not unanimous, but it must be admitted that, both in numbers and in weight, the opinions in favour of the trap prevailed. Dr. Louis Parkes, Mr. Patten Barber (Borough Engineer

Islington) and Mr. Isaac Young (Chief Sanitary Inspector, Battersea), who introduced the discussion, were all in favour of the trap, as were most of the speakers.

Major Horrocks' conclusions may here be repeated (see JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, October, 1907):—

(1) Specific bacteria present in sewage may be ejected into the air of ventilation pipes, inspection chambers, drains, and sewers by (*a*) the bursting of bubbles at the surface of the sewage; (*b*) the separation of dried particles from the walls of pipes, chambers, and sewers, and probably (*c*) by the ejection of minute droplets of flowing sewage.

(2) A disconnecting trap undoubtedly prevents the passage of bacteria, present in the air of a sewer, into the house drainage system.

(3) An air inlet, even when provided with a mica valve, may be a source of danger when it is placed at or about the ground-level.

Sewage Purification.—Dr. George Reid opened a discussion at the Royal Sanitary Institute in February, 1907, on the question, "To what extent must authorities purify sewage?" He did not admit that it was the duty of an authority to take such elaborate measures of purification as to render their sewage effluent, if discharged into a river, in any way potable; he considered that it would be cheaper and more effective if whatever purifying process might be necessary were carried out at the intake; and he maintained that the water authority should be held solely responsible for the purity of the water they supply. In regard to shell-fish layings and watercress beds, he considered that the only remedy was the removal of the beds to a place of safety. Professor Bostock Hill agreed; he thought that instead of endeavouring to raise false standards of security by going to the expense of sterilisation when the principle was wholly wrong, it was their duty to remove from the list of possible sources of water supply all streams which received a large quantity of sewage. As a standard of sufficient purity in a stream that receives a sewage effluent, he believed there was none better than the existence of fish-life. If a stream were sufficiently oxygenated, fish would carry on a healthy existence in it; and that was the only definite, practical, and regular standard, which from an economic point of view could be agreed to as common to all localities. Mr. Lowcock, speaking as a water as well as a sewerage engineer, thought that if a water authority chooses to take water from a stream into which sewage effluents are discharged above the intake, this authority ought to be responsible, and pay for all treatment necessary to render pure the water distributed by it; but if, on the other hand, any sewage authority discharges an effluent into a stream already used for purposes of water supply, the sewage authority should be held absolutely responsible, and pay for all necessary treatment of the effluent so turned in. He thought that the quality of an effluent must be considered in connection with the condition of the stream into which it is discharged; speaking generally, it should not be putrescible,

and should produce no bad effect whatever on the stream. Dr. Barwise agreed with Dr. Reid in the main; the responsibility should be laid on the persons using the water, whether a water company distributing it for drinking, or the owners of a watercress or oyster bed. It would be infinitely cheaper to sterilise the water taken in from the river before it was filtered than to sterilise the whole of the effluents from sewage works. [But this obviously depends on the relative quantities of effluent and intake; it might be much cheaper to sterilise the effluent of a small town than the water supply of a large one; *e.g.*, the Thames water supplied to London.] Dr. Barwise thought in exceptional cases, when a sewage outlet is close to a water intake, that the best means of purification (better than the use of electricity, ozone, or chemicals) would be afforded by passing the effluent through a sand filter before entering the stream. Dr. Fowler also agreed that the proper place to sterilise was not at the sewage works, but, if done at all, at the waterworks; he did not see how pollution could be avoided until storm overflows were abolished. He suggested the use of ozone at the waterworks intake; but wherever possible a pure supply should be obtained. Dr. Rideal quoted Rudolf Hering's short hygienic dictum: "Nothing to be discharged into a stream without purification; nothing to be taken from a stream without purification"; and considered this to be the proper position for the Royal Sanitary Institute to adopt. With this opinion the present writer agrees; but, as was said on another occasion by a well-known authority: "The bearing of this observation lays in the application on it." What is to be done in any individual instance? The drinking water standpoint is the opposite of the sewage effluent standpoint; sometimes one will prevail, sometimes the other. Circumstances alter cases.

V.—Causation and Prevention of Disease.

Diphtheria.—Dr. D. S. Davies, of Bristol, made some suggestive remarks in his address on "Diphtheria" to the Society of Medical Officers of Health (*Public Health*, March, 1907). "We may accept without hesitation the grouping of diphtheria cases into marked clinical cases, slight ambulant cases, and carrier contact cases; and we must recognise the fact that the potency of a case for spreading the disease is inversely as its severity.

"The marked clinical cases, which are readily notified, should obviously receive early antitoxin treatment and sufficient isolation; if not possible at home, in hospital. To this extent hospital provision for diphtheria is essential; but obviously, from the nature and the number of contact cases showing little or no clinical symptoms, hospital isolation of obvious cases can act only in a very limited sense as a preventive measure. The essential towards prevention is an efficient organisation for the bacterial

examination of throats and noses of all contacts, whether members of an infected household, or class-mates in an infected school. In this way the remaining subjects fall into three classes:—

"*A*.—Actual mild cases showing some, probably slight, clinical symptoms.

"*B*.—Cases without obvious clinical symptoms, but yielding organisms classed as true diphtheria bacilli (carriers).

"*C*.—Cases without clinical symptoms, but yielding organisms classed as pseudo-diphtheria or Hoffmann bacilli (pseudo-carriers).

"With regard to classes *A* and *B*, we have always secured isolation in hospital or at home, exactly as in ordinary notified cases. . . . Considerably greater difficulty is felt in dealing with cases who present no clinical symptoms, and yield on examination doubtful forms of diphtheria [bacilli]. If such a case is a close contact of an actual clinical case, and especially if a child of school age, school attendance must certainly, in my opinion, be prohibited. I attach little importance to Hoffmann in nose or throat of children examined at hazard in unaffected schools or institutions, especially after long months of epidemic prevalence, when probably the majority of the population has become leavened with some sort of diphtheria bacillus; but during the early months of diphtheria prevalence, close contacts of actual cases presenting any suspicious forms may, in my opinion, form actual sources of infection. From this it follows that the importance of Hoffmann bacillus varies in the different stages of invasion. In a populous district such cases may accumulate so rapidly that hospital isolation is impossible; and we have met the difficulty by establishing in three infected districts temporary out-patient hospitals, at which such contacts might receive attention from a trained nurse acting under medical supervision."

In regard to school closure, Dr. Davies agrees with Dr. Kerr: it is rarely necessary; it would only be resorted to as a confession of failure, either from want of time or want of staff; bacteriological examination of suspects, and exclusion, are efficacious in immediately arresting spread in 95 per cent. of the outbreaks. This high efficacy is, however, only to be looked for when the district has already been fully leavened by diphtheria prevalence.

In regard to carrier cases, Dr. Davies accepts the two conclusions of the Massachusetts Committee (1902): "(1) It is impracticable to isolate well persons infected with diphtheria bacilli, if such persons have not, so far as is known, been recently exposed to the disease": the issue of precautionary instructions to such persons is advocated. "(2) It is not advisable, as a matter of routine, to isolate from the public all the well persons in infected families, schools and institutions." Wage-earners, business and professional men may be excepted; but children in infected families should be kept from school and from public places; teachers and nurses, and milkmen should not be allowed to continue at work. In

schools and institutions all infected persons, sick or well, should, if the infection be not too widespread, be separated from the others. "When diphtheria appears in a community which has for some time been free from it, it is advisable to isolate all persons who have been brought into contact with the patient until it shall have been shown that they are free from diphtheria bacilli."

Dr. Davies considers that the phenomena of recent diphtheria outbreaks suggests that owing to the extremely widespread occurrence of atypical forms, especially Hoffmann, among persons not clinically recognised as suffering from diphtheria, an acquired immunity is in time developed in large numbers of young persons, and that the modified phenomena of the later stages of the epidemic may be ascribed to this.

Von Sholley has found virulent diphtheria to be present in the throats of persons, free from any throat or other illness, in 18 out of 1,000 cases examined; in only one of these was there a possible history of exposure to infection several weeks before. Among 202 persons belonging to families in which diphtheria had broken out, and who were not themselves attacked, virulent bacilli were found in only 14 cases (*Journal of Infectious Diseases*, June, 1907). Cumpston relates that out of 1,019 cases of scarlatina throats examined, *B. diphtheriæ* was present in 7·36 per cent., Hoffmann's bacillus in 1·07 per cent. (*Journal of Hygiene*, July, 1907.)

Enteric Fever.—Dr. W. G. Savage has contributed a practical paper on "Recent Work on Typhoid Fever Bacteriology in Relation to Preventive Measures" (*Public Health*, October, 1907). He draws attention to four points: (1) Typhoid bacilli are frequently excreted in the urine in about 20 per cent. of cases; this is well established, and familiar to most, but he suggests that the obvious practical measures resulting from this knowledge are not habitually followed out. (2) Typhoid bacilli may persist in the body, and be found in the fæces and gall-bladder, long after all clinical symptoms have ceased. It appears that women form a large percentage of "chronic bacilli carriers;" sixteen out of twenty-two cases (Leutz), and nine out of twelve cases (Klinger). (3) Typhoid bacilli may be found in the excreta of healthy persons who apparently have never suffered from typhoid fever; they have been in contact with cases of typhoid, and are analogous to the contact cases of diphtheria outbreaks. (4) A certain proportion of cases, clinically diagnosed as typhoid fever, are due to another organism, the *paratyphoid* bacillus; according to Boycott (1906) about 3 per cent.; according to Zupnik, 7 per cent. of "typhoids" are really paratyphoid cases; Wells, of Chicago, estimates the proportion as 10 per cent. in that city; and Kolle reckons the proportion in Germany (1905) to be about the same.

Drs. D. S. Davies and Walker Hall have reported an instructive instance of "carrier infection" at the Brentry Reformatory, Bristol (Epidemiological Section, Royal Society of Medicine, April, 1908). This institution

had been free from typhoid for some years until 1906, when a case occurred in September, and three others in November; one case occurred in May, 1907, and in July to November there were twenty-two cases. These fell ill at irregular intervals, and in batches of three, four, or five, sickening at about the same time, indicating more or less simultaneous infection. After enquiry in various directions, it appeared that the infection was conveyed by milk; and that, as this was sterilised, infection must have been brought about *after* sterilisation, in which event the infecting agent might be a "carrier" case. On further enquiry it was found that six of the female inmates had previously suffered from typhoid, and that one of these was employed as cook and dairymaid. She was removed from the dairy on November 13th; no cases of enteric occurred after November 25th. On examination, this woman was found (though not until December 20th) to be passing typical typhoid bacilli in the stools; this occurrence of these bacilli in the stools was found to be intermittent. None of the other persons who had previously suffered from typhoid were found to be "carriers." It appeared, therefore, that the Brentry epidemic was due to infection from this particular "carrier," though she was at the time apparently in perfect health. That this was the case was proved beyond reasonable doubt when it was ascertained that, while this woman was employed at another institution at Brislington in 1904, there had been an outbreak of twenty-five cases of enteric fever, prevailing during the time when she was employed in the kitchen, and ceasing twenty days after she had left this occupation. Here also the milk had been boiled, but infection doubtless occurred subsequently. The authors say that "there is apparently little doubt that the transference of infection by carrier cases may be defined as 'gross,' and that definite though minute amounts of infective material are conveyed into the food or milk by the hands of the carrier, through carelessness and neglect to wash the hands after attending to the calls of Nature."

A patient in a Strassburg lunatic asylum suffered from typhoid in 1903; she recovered, and after she began to mix with the other patients occasional small typhoid outbreaks occurred, and in 1905 the infection was traced to this woman. Her stools were examined, and found to contain *B. typhosus*. She was then isolated and no further cases occurred. She continued to pass motions containing the bacilli from time to time, and died from typhoid sepsis in 1906. At the *post-mortem* examination typhoid bacilli were found *passim*, in spleen, liver, bile, wall of gall-bladder and inside of gall-stone. As she had been isolated for a whole year, she must have re-infected herself from the gall-bladder or bile-ducts (Levy and Kayser, *Munch. med. Wochens.*, December, 1906).

Levy and Wieber (*C. f. Bakt.*, 1907) relate that a woman, having been confined on October 1st, was completely restored to health twelve days later. On October 21st she fell ill, and kept to her bed for some weeks with "fever"; her blood agglutinated at 1 in 200; the typhoid

bacillus was recovered from the stools twice. How did she become infected when there was no case of the disease in the house or in the neighbourhood? Her mother had recently arrived to be present at her accouchement; she lived in a village where many cases of typhoid had occurred in the preceding spring, she had herself been ill for six weeks with "influenza." It was thought that this might have been a typhoid attack; the blood was examined and found to agglutinate at 1 in 50, and typhoid bacilli were found in the stools. The mother, therefore, infected her daughter with typhoid bacilli that she had retained in her intestine, though she was herself in excellent health; the daughter was especially prone to receive infection, being debilitated after her accouchement.

Kirchner, of Berlin, in a pamphlet (1907) supporting Koch's views as to typhoid transmission in opposition to the Pettenkofer theory, quotes the case of a company of musicians who travelled from Trier (Treves) to Bergen in Norway; shortly after their arrival an outbreak of enteric occurred in the hotel where they were staying; this was found to be attributable to one of the musicians, who had brought the bacilli with him from an infected locality in Trier.

The significance of the paratyphoid group of bacilli was discussed at the Berlin Hygienic Congress in 1907, the subject being introduced by Loeffler. From the reports at present available it does not appear that any definite conclusion was arrived at.

Malaria was discussed at the British Medical Association meeting in July, 1907. Professor Simpson, pointing out that different conditions demand different methods of applying anti-malarial sanitation, adduced as examples: (1) Such tracts of country as the Roman Campagna, where large works of drainage and reclamation are required; pending these, the community is best protected by mosquito-proof houses, mosquito curtains, destruction of breeding places in and around the immediate premises, veils and gloves in the evening, and quinine as a prophylactic in the unhealthy season. (2) In localities subject to tidal floodings: Port Swettenham, in the Malay Peninsula, is a small town, built on raised land reclaimed from a swamp, and adjoining swampy land covered with mango trees; it was so unhealthy from malarial fever that its abandonment was contemplated. On Dr. Watson's recommendation, it was decided to construct a bund, so as to prevent the tidal waters from the marsh overflowing on to the low land close to the town; this low land was cleared, and drained by ditches, which passed through the *bund* with small wooden sluices at their outlets; any low-lying places that could not be drained were filled up. As a result, Port Swettenham had been freed from malaria. Professor Simpson considers that "the success which has been achieved shows that no place with similar conditions, however malarious, should be considered to be beyond remedial measures." (3) Small marshes at the foot of hills, with a water-logged soil, are best dealt with by constructing catchwater drains, which intercept the flow of water

coming from the high lands, and carry it away to the lower natural waterways, without permitting it to lodge in, and waterlog the low lands at the hill-foot. The method is much used in Italy, and has been employed with excellent results by Dr. Watson at Klang; it can be easily carried out by a few coolies cutting ditches to a proper gradient under supervision. The cost is small, the results in drying the ground and removing mosquito breeding grounds are remarkably good. (4) Pools in water-courses, or nullahs, that are formed at certain seasons, not uncommonly are a cause of malaria. A few coolies, by cutting channels from the pools into the main stream remove the stagnancy of the water and dry up the pools. Hong Kong is an instance of good results from this practice, also Ellichpur Cantonment in the Berars, about three miles from the Satpura range. Here, Colonel Swain, by cutting channels from the stagnant pools in the river to the central streamlet, thus draining them, and by filling up, or treating with kerosene, the pools that could not be drained, eradicated malaria. Major Nott, I.M.S., quoted the instance of Burhampur, Lower Bengal, where the expenditure of about £70 on coolie labour for draining and the application of kerosene oil, checked the breeding of *Anopheles* in a very short time. Work on similar lines has been carried out in various other parts of India. It is desirable that medical officers should give accounts of any such measures within their own personal experience for publication in this Journal, or elsewhere.

Ed. and Et. Sergent, describing the fifth anti-malarial campaign in Algeria (*Annales Pasteur*, 1907), state that 2,000 persons (natives) were treated with small daily prophylactic doses of quinine; 439 of these were examined before and after the treatment; in 38·8 per cent. the enlargement of the spleen was diminished or cured; in 8·2 per cent. it persisted. Of 567 control cases not treated with quinine, in 6·2 per cent. the spleens were ameliorated, in 32·6 per cent. they were enlarged.

Plague.—Two further series of reports have been published by the committee appointed by the Secretary of State for India, the Royal Society and the Lister Institute, forming two numbers of the *Journal of Hygiene* (July and December, 1907). The researches have been most minute and laborious, and the number of facts detailed is enormous. These have been admirably gathered and digested into summaries, at the ends of the various sections.

Report XI.—As to the diagnosis of plague in rats, it is stated that naked eye examination by a competent observer is more satisfactory than microscopical examination alone. The most important *post-mortem* features are: typical bubo (submaxillary, axillary, and inguinal); "granular" liver (small necrotic foci scattered over the surface and through the substance); hæmorrhages, especially subcutaneous ones; abundant clear pleural effusion. Microscopic examination for *B. pestis* is best directed to the buboes, where the bacillus is most likely to be recognised in large numbers; the characteristic involution forms are present in at least

50 per cent. of the cases. Cutaneous inoculation of guinea-pigs, by shaving the abdomen (no soap or water being used), with partial removal of epidermis so as to produce a slightly bleeding surface, and rubbing in a piece of an organ (such as a bubo) of the suspected animal, is of great value for diagnosis.

As to transmission of the disease in rats (Reports XIII., XIV.), feeding experiments were carried out, which showed that Bombay rats (*Mus decumanus*) fed on the viscera of dead plague rats were susceptible (89 out of 415 became infected, *i.e.*, 21·4 per cent.), but to a less extent than rats caught on board ship (18 out of 41, *i.e.*, 43·9 per cent.), the Bombay rats possessing a high degree of immunity owing to the long continuance of the epizoötic. Rats caught in Punjab villages (*M. rattus*) were also found to be highly susceptible to feeding (19 out of 28 cases, *i.e.*, 67·9 per cent., a larger dose being given them than in the case of the other rats). The lesions found are the same as in rats naturally infected, with two striking differences: (*a*) With naturally infected rats the primary bubo is most often in the neck, with the fed rats in the mesentery; (*b*) in the former, the stomach and intestines show no marked pathological change; in the latter, there are marked lesions in the intestines. Intestinal infection in rats, therefore, appears to be rare, they do not become infected by eating the carcases of their comrades. A large number were fed on the urine of human plague cases; no infection resulted.

Experiments as to transmission by fleas from animal to animal (in continuation of those in the previous Report, No. I. of 1906) showed that rat-fleas (*Pulex cheopis*), fed on septicæmic rats' blood could remain infective for at least ten days, and more likely fifteen days, during the epidemic plague season; in the non-epidemic season they remained infective for only seven days. Experiments (27 in number) with cat-fleas (*P. felis*) were not successful; and with human-fleas (*P. irritans*) were only successful in 3 out of 38 cases. It was found that multiplication of plague bacilli occurs in the flea's stomach (more often in the epidemic than in the non-epidemic season); and that the bacilli are present and infective in the rectum and fæces of fleas taken from plague rats; but they have not been found in the body cavity, or salivary glands. "No evidence has been obtained in favour of infection by contaminated mouth-parts or regurgitation from the stomach, but the possibility of infection by such means cannot be excluded" (Report XV.).

In continuation of experiments recorded in the 1906 Report, the conclusions then arrived at were corroborated that in the epizoötics studied fleas, and fleas alone, were the transmitting agents of infection (Report XVI.).

Report XVII. confirms and amplifies the conclusions of the 1906 Report (No. I, Part iv.) that, in a plague-infected house, the infection is due to the presence therein of infected rat-fleas, which are capable of transmitting the disease to animals.

Other reports deal with the characters of the Indian rat-flea (*P. cheopis*); with the fact that under certain circumstances this flea will make use of man as a host, and will readily bite and feed on him; and with the phenomena of chronic rat plague.

The third series of reports, forming a bulky volume of 300 pages, consists chiefly of detailed accounts of observations on plague in Bombay city, in some neighbouring villages, and in some villages in the Punjab. There is also a digest of recent observations on the epidemiology of the disease (Report XXI.); the opinions of a large number of observers and writers are noted, but no general conclusions are drawn, either from the observations summarised or from the Committee's own laborious investigations.

As a practically successful "disinfectant," or prophylactic against plague, Dr. J. C. Turner, Health Officer to the Bombay Municipality, recommends "pesterine" the residue of the distillation of crude petroleum (*huile de schiste*). It readily destroys fleas. When a room is to be disinfected this substance should be sprinkled on the floor, before the furniture is cleared out, in order to catch any fleas that may be dislodged during its removal: after the room has been emptied, pesterine is spread over the ceiling and upper part of the walls; then all over the walls, in nooks and cracks and on ledges, then on the floor, then it is poured into every rat-hole. The room is left for twenty-four hours undisturbed, and is then fit for re-occupation. Pesterine is not readily inflammable, and is cheap (2 annas per gallon); it may be used for disinfecting excreta.

Small-pox and Vaccination.—A new General Order was issued by the Local Government Board in September, 1907, amending the Vaccination Order of 1898, in accordance with the Vaccination Act, 1907. The object of this Act is to effect an alteration in the legal method of obtaining exemption from penalties for neglecting to have a child vaccinated, but without otherwise interfering with the provisions of the Vaccination Acts, 1867 to 1898. Hitherto, the "conscientious objector" has had to satisfy two justices, or a stipendiary, or Metropolitan police magistrate, in petty sessions, that he conscientiously believes that vaccination would be prejudicial to the health of his child; by the new Act all he has to do is to make a statutary declaration of his conscientious belief.

Dr. Myer Coplans, in a paper on "Medical Inspection of Schools" (Epidemiological Section, Royal Society of Medicine, 1907), gave statistics of vaccination amongst the school children at Stroud, Gloucestershire: of 4,716 children in the "big school," 35·9 per cent. were found to be unvaccinated; and of 1,932 in the infant school, 53·6 per cent. were similarly found to have no vaccination marks. He draws attention to the remarkable falling off in vaccination among the children born in 1896 to 1902. In the latest Report of the Medical Officer to the Local Government Board (for 1905-1906, published in 1907), the percentage of children born in 1904, and remaining unvaccinated, in the whole county of Gloucester, is given as

26·1; in the Stroud Union, 44·3; this percentage is exceeded in three other unions in the same county. It is perhaps not generally realised that there are districts in this country where a very large unvaccinated population is growing up, to the danger of themselves and their neighbours,

Tuberculosis.—The International Hygiene Congress at Berlin, in September, 1907, discussed the question of etiology, especially with regard to the relative importance of the alimentary and the pulmonary avenues of infection. Ravenel, of Philadelphia, considered that the alimentary tract was a frequent portal of entry, especially in children, the milk of tuberculous cows being a source of infection in many cases; he believes that the bacilli can pass through the intestinal mucous membrane by the lacteals into the blood and so to the lungs, where they are largely retained. On the other hand, von Schwetter, of Vienna, believed the lungs to be primarily affected in by far the greater number of cases. Flugge allowed that infection might occur from the presence of tubercle bacilli in the food; but maintained that while pulmonary tuberculosis can be produced experimentally by inhalation of droplets floating in the air, containing only a few bacilli, if these are given in the food, the number present must be millions more, in order to produce infection; and the symptoms and the fatal result occur much later. Although, experimentally, inhalation is the more dangerous, one must not necessarily conclude that it is the more important mode of infection. It depends on the opportunities afforded. If intestinal infection is frequent, and pulmonary inhalation rare, the latter loses its relative importance. For pigs and calves fed on tuberculous milk this mode of infection predominates; cattle may become infected by inhalation, through living with coughing tuberculous cows. For man the relative infection frequency varies; with children, consumption of tuberculous milk and butter is a danger, but Flugge considers that by far the largest number of cases of human tuberculosis are the result of the inhalation of tubercle bacilli ejected in the form of droplets by tuberculous patients.

Ribbert, of Bonn, concludes that from *post-mortem* examination it is the fact that in the great majority of cases of tuberculosis the disease is localised in the bronchial glands and in the lungs, that the bronchial glands are the only glands involved, and therefore that the tuberculosis can only be of aërogenic origin. Calmette and Guerin, however, have recorded feeding experiments on adult bovines, with bovine tubercle bacilli; and state that adult, as well as young animals, readily contract tuberculosis by the intestinal route; that the so-called primary pulmonary tuberculosis of the adult is most frequently of intestinal origin; and that this is the most effective of all modes of infection. Calmette, indeed, says that the most usual mode of tuberculous infection is by the ingestion by the alimentary tract of fresh virulent bacilli, in a state of fine emulsion, such as one finds in milk or in sputa (*Bulletin Pasteur*, 1907, 739). It must be remembered that Chauveau, as far back as 1868, had said that

the digestive tract, both in man and in cattle, constitutes an avenue of infection just as favourable, and as likely, for the propagation of tuberculosis as the pulmonary.

Pfeiffer and Friedberger (*Deutsche med. Wochens.*, September, 1907), have described experiments on guinea-pigs, both by feeding and inhalation, minimal doses of bacilli being used, to approximate natural conditions of infection. To 28 animals 9 cc. of dilute emulsion (estimated to contain three million bacilli) were administered by the mouth; while 29 others were made to inhale the same quantity in the form of droplets. After fifty days the animals were killed and examined. Of the 29 infected by the respiratory tract, 22 presented tuberculous lesions of the lungs, 15 having also lesions in the spleen; in none were the intestines or mesenteric glands affected. Of the 28 to which tubercle bacilli were administered through the stomach, 4 showed lesions of pulmonary tuberculosis, 3 others showed lesions of the mesenteric glands, 21 were free from any sign of tuberculous infection. The authors conclude, therefore, that the principal danger lies in inhalation.

With regard to the relation between avian and bovine tubercle bacilli, and the infectivity of the former in bovine animals, A. E. Mettam (*Proc. Roy. Irish Academy*, 1907) inoculated a heifer with avian bacilli in broth culture, originally obtained from a turkey; after thirty-six days tubercles were found in spleen, liver, and various glands; also there were the lesions of tuberculous broncho-pneumonia. A similar culture was given to a young bull by the stomach pump; after seventy-seven days tuberculous lesions were found in the mesenteric glands, but inoculation of these into a rabbit proved negative. Shattock and others have described (Pathological Section, Royal Society of Medicine, 1907) feeding and inoculation experiments on birds at the Zoological Gardens. In contradiction to the common belief that avian tuberculosis is contracted from a human source, *i.e.*, ingestion of phthisical sputum, they found that pigeons could not be experimentally infected by feeding them with phthisical sputum; infection, however, did take place when they were fed with tuberculous material derived from other birds; the authors conclude, therefore, that the organisms of avian and human tuberculosis are distinct. Comparative observations were made on the amount of phagocytosis that occurred when human tuberculous serum was saturated with human and with avian tubercle bacilli; the opsonin was removed in one case as markedly as in the other; but the authors do not regard this negative evidence as so important as the positive differentiating results obtained by feeding and inoculation.

A few observations of immediate practical importance may be mentioned. Mr. J. A. Gilruth, Chief Veterinarian and Bacteriologist to the New Zealand Department of Agriculture, in his report for 1906, stated that during the three years ending March, 1905, out of nearly 240,000 fat bullocks and heifers examined, 3·7 per cent. were found to be tuberculous,

though all were apparently healthy and in good condition; of nearly 46,000 milch cows, about 10 per cent. were tuberculous; out of nearly 125,000 pigs nearly 4 per cent. were tuberculous, the situation of the lesions clearly showing that in most cases infection was due to contaminated food, probably tuberculous milk. Schröder and Cotton (Washington Bureau of Animal Industry, 1906) reported that pigs showed lesions of the submaxillary glands in every case observed, pointing to the channel of infection; Mr. James King, of the Central Cattle Market, Islington, has made the same observation.

At a conference of representatives of twenty-eight out of the twenty-nine City and Metropolitan Borough Councils, held in June, 1907, it was resolved that notification of pulmonary tuberculosis should be made compulsory; and that this disease should be included amongst the "dangerous infectious diseases" in regard to which provision is made in the Public Health (London) Act, 1891, for disinfection of premises, bedding, clothing, &c.; and special regulations are laid down as to letting lodgings or houses in which such cases have occurred. The Local Government Board were also asked to make the Dairies, Cowsheds, and Milkshops Order of 1885, with its amendments, compulsory on local authorities, and to make tuberculosis a "dangerous infectious disease" in connection with milking of cows and distribution of milk (*i.e.*, persons while so suffering must not engage in these occupations). The provision of sanatorium treatment for the poor in the early stages of the disease was declared to be necessary.

Notification and sanatorium treatment, the latter for the training of patients in the proper management of their own cases, are two essential measures for prevention of the spread of tuberculosis. Dr. Newsholme gives the following advice to patients leaving the sanatorium (*Journ. Roy. San. Inst.*, February, 1907): (1) The spit bottle should always be carried in the pocket, and daily washed out with boiling water after emptying its contents down the w.c.; at home if the bottle is not used, spit into paper or rag, and burn this at once. (2) Be careful not to cough directly opposite to any other person; always hold a handkerchief to your mouth when coughing. Change your handkerchief every day, and put the soiled one into water. (3) In order to maintain a condition of good nourishment, take a glass of milk with each of the three chief meals, in addition to the ordinary food. (4) Keep on taking cod-liver oil each day until you have no cough, unless otherwise ordered by your doctor. (5) Do not take beer or other alcoholic drinks. Money thus spent is wasted. (6) Keep up the practice of sleeping with your bedroom door *and* window wide open; one of these without the other does not suffice. To keep warm, wear plenty of woollen clothes. (7) It is imperative that you should sleep in a separate bed; and if possible have a separate bedroom. (8) Do not run the risk of inhaling dust if you can avoid it, either in the house or when at work, or in the street. Always insist on the "wet cleansing" of rooms instead of dry dusting or sweeping.

Reference must be made to a very valuable *Report* on "Sanatoria for Consumption, and Certain Other Aspects of the Tuberculosis Question," by Dr. H. T. Bulstrode (1908), forming a supplement to the *Report* of the Medical Officer to the Local Government Board for 1905-06. Not only is there a detailed account of the various sanatoria in the kingdom; but there is also a most interesting description of the working of the System of Compulsory Insurance against Sickness in the German Empire, demonstrating the great importance of this movement in the campaign against tuberculosis. Dr. Bulstrode also discusses generally the various modes of causation of the disease, and the influences of notification and sanatorium treatment on its prevention.

Reprint.

THE EYE IN SPORT.[1]

[The blocks illustrating this article were very kindly lent by Mr. C. B. Fry, editor of *Fry's Magazine*.—Ed.]

By Captain W. B. FRY.
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The physiology of games, especially with regard to eyesight, brings to light so many facts, both interesting and useful, that the study is well worth the while of the practical sportsman whose object is to take up a game and waste as little time as possible in learning to play it.

The attainment of this end is certainly accelerated by understanding those parts of the body that must be employed in playing these games, namely, the eyes, the brain, and the voluntary muscles.

Just as a man who drives a car, and, understanding the engines of it, knows what they can do and how they go wrong, is in a far better position than the man who can merely drive; so the man has the advantage who, in playing games, knows the functions, the capabilities, and the shortcomings of these same eyes, muscles, nerves, and brain. The knowledgable man always gets there first.

To start with the eyes. What are they? They are two small cameras set in our faces with the centres of their lenses about 2½ ins. apart, the centres of these lenses corresponding, of course, to the centres of the pupils. Now, with two cameras two images are formed, and at first sight it would seem that we must see double, a condition that actually does occur in certain morbid states, and is occasionally experienced by

[1] Reprinted, by kind permission, from *Fry's Magazine*, March, 1908.

those who indulge to excess in alcohol; for it is obvious that each retina, which is the focussing screen of these little cameras, sends a separate message through the optic nerve to those parts of the brain where what we see is realised and understood.

How is it, then, that such a difficulty does not occur? Simply in this way: one eye must manage the business of selecting the object, and the other eye, deferring to the first, focusses the same image selected by the more determined eye. The eye which is the master (or managing) eye, faces square on to the object, and the helping eye converges slightly towards the master.

The ignorance of most people with regard to the eyes, and the part played by them as special sense organs, can only be explained by the fact that great accuracy of vision is not now a vital necessity in the struggle for existence; if it were, the physiology of the eyesight would be common knowledge, and not the monopoly of the few.

That this general ignorance exists is clearly demonstrated by the methods with which mankind approaches games of skill. While much has been said and written, and much probably has still to be said and written, on the subject of games, and how to play them, unless the nature of these instructions is amended in a great measure, this question will still assuredly arise in the minds of those who, interested in games of skill, apply to their study a certain degree of intelligence—"How has the overwhelming importance of the eyesight come to be so neglected by those who instruct in the art of acquiring skill in games?"

The obvious answer is that these instructors know little about optics and the eyesight; and that science, unable to grasp the importance of playing a game with accuracy, has been slow to throw any light into the darkness. The Englishman desirous of attaining a high standard of skill in playing games is ready to sacrifice quite long periods of his lifetime in training the voluntary muscles of his body to perform complicated movements; but with a want of knowledge of facts which is quite pathetic, almost invariably ignores that great factor in practically all games of skill —the eyesight. Or else he accepts a mere rule of thumb. Take, for instance, the oft-repeated maxim of the experienced golfer to the tyro— "Keep your eye on the ball." This is said probably thousands of times in the course of the year, but probably not one of those who say it could explain how much more accurate it is to say "eye" than "eyes"; very few of them know that of the two eyes which Nature has dealt out to us, one is the "master eye," and that it is with this eye that we judge of the position of an object in space in relation to our own body.

The following simple experiment readily proves the existence of the "master eye," and enables one to determine in oneself which it is. Take a piece of notepaper, and in the centre of it cut out a small circle of about 1 inch in diameter; place the cut-out portion on the floor, and with both eyes open hold the paper at about arm's length, so that the white

object is visible through the hole. Now, first close one eye, say, the left, and if the object is still visible through the hole, then the right eye, which remains open, is the "master eye," for, if this eye is closed and the left now opened with the paper still held in the same position, the white object disappears from view, being hidden by the rest of the notepaper, the head being kept rigid the whole time. Of course, in the reverse case, if the white object disappears on the closure of the left eye, then the left eye is the "master." A consideration of this little experiment brings some exceedingly interesting points into notice, besides proving to oneself that the "master eye" exists, and telling one which eye possesses the

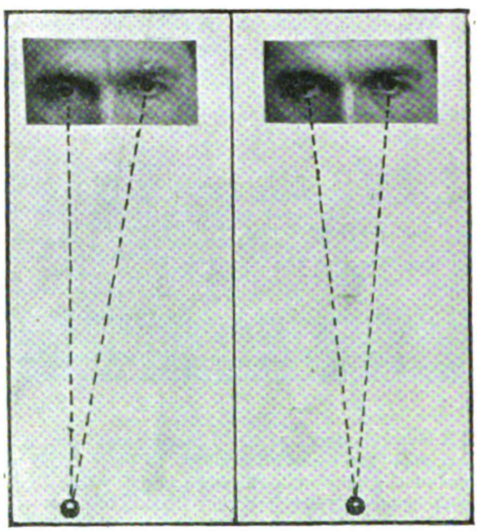

FIG. 1 FIG. 2.

Figs. 1 and 2.—When the idea of aiming is in the mind, the mind is consciously or unconsciously endeavouring to get the object, the weapon (or hand), and the "master eye," all three *into the same vertical plane.* Hence the line from the "master eye" to the object is *the line of sight involved in all questions of aiming.* The line from the other eye to the object scarcely counts; and, if treated as the line of aim, actually spoils correctness of aim. In figs. 1 and 2 the right eye is taken as the "master eye." The lines of sight in aiming, therefore, converge on the object as in fig. 1, and *not* as in fig. 2. Unless this is understood the whole theory of aiming in games and sports is misunderstood.

mastership. For, now get someone else to perform the experiment, and it will be observed that when the paper is held in position with both eyes open that the eye which will be found to be the "master" is in a straight line with the hole in the paper and the white object, the other eye being to one side of a line which joins the object and the hole, and which, being prolonged towards the face, of course reaches the "master eye."

To understand what this means, and why on closing the "master eye"

the white object disappears, note that "master eye," hole, and object are all in the same vertical plane, while the secondary eye is 2½ inches wide of this plane.

What does all this involve, and how is it important? In most games of skill what is known as "aiming" is an essential factor, whether the instrument leaves the hand like a thrown ball, or be retained like a bat used to hit a moving ball.

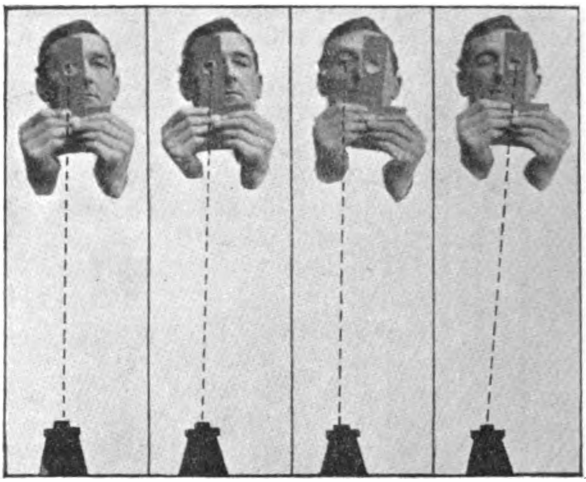

FIG. 3. FIG. 4. FIG. 5. FIG. 6.

Figs. 3, 4, 5, and 6 show the facts of the "master eye," *i.e.*, here the right eye. If you look at an object with the aiming-intention in your mind with both eyes open (*e.g.*, as at the centre of the lens of a camera), and if while looking you interpose a card with a hole in it between your face and the object, you cannot see the object unless the object is in the straight line between the "master eye" and the object. The line of aiming sight is left undisturbed if, as in fig. 3, both eyes are open and the hole is in the straight sight-line of the "master eye"; or if, as in fig. 4, the non- "master eye" is shut; or if, as in fig. 5, the card is moved clear of the sight-line of the "master eye" and the hole is opposite the non- "master eye." But if, as in fig. 6, the "master eye" is shut, then the non- "master eye" is *artificially* made the "master eye," and the line of its sight becomes the line of aim. Faults of aim occur when the sight-line of the real "master eye" is blocked, and the mind and hand work as though the line of aim were still the line of sight of the "master eye," when, in fact, the mastership has been artificially transferred to the other eye. The effect is that you see down one line and aim down another, and therefore your action is in the wrong vertical plane.

When we concentrate our gaze on some object with, say, the intention of throwing something at it, the "master eye" is the eye which locates the position of the object in space in relation to our own bodies, and in order to thus locate it we unconsciously place the "master eye," so that this eye is exactly plumb opposite the object, the other eye, as stated above, being a little to one side.

Now, by methods that will be explained later, the brain realises where

this object is by ascertaining first how far it is off by the state of the ciliary muscle of the lens which manages the focussing of the object on the retina; and, secondly, what vertical plane it is in by the condition of the muscles of the master eyeball which turn it this way and that. *Why is this vertical plane important? Because it is the one in which the muscles of the body have learnt to project anything if one wishes to hit an object.*

Unconsciously the hand is made to travel in, or as nearly as possible in, this vertical plane which includes the object and the "master eye." Now this is easily proved. Get someone else to aim, assegai-fashion, with a long stick held above and behind the head; it will then be seen that in aiming one is endeavouring to bring the missile into the same vertical plane which includes the object and the "master eye." One generally aims in this fashion by moving the hand backwards and forwards, and it is most convincingly evident that the hand is manœuvring to get the instrument in exactly the same vertical plane as the "master eye" and the object. Try any series of experiments on these lines and this will be found universally true. Watch a boy throw a stone at a bird. He throws in such a manner that the hand in throwing cannot be brought into the same plane with the "master eye" when the head is erect upon the shoulders, so head and neck are bent over in order that the "master eye" shall be brought into the same vertical plane as the hand has to pass through in throwing; and from this position he is able to judge whether the object, the eye, and the hand are all in this very important vertical plane.

That we must speak of planes, and not merely about straight lines from the eye to object, is clear when we consider the most accurate of all aiming instruments, the rifle, the accuracy of which entirely depends upon two straight lines being in the same plane. The line joining the fore-sight and back-sight, and the line representing the centre of the barrel, are two straight lines one a little above the other in the same vertical plane, and it is in this plane that the projectile, or bullet, is forced to travel.

In aiming with a rifle one places the "master eye" in the same vertical plane as the fore-sight and back-sight, and then pointing it in the direction of the bull's-eye one makes the "master eye" plane—this plane being now the same as that of the sights and the centre of the barrel—coincide with a vertical plane which cuts the bull's-eye.

Now, the barrel, the eye, and the object being in one vertical plane, a correct elevation is the only requisite needed to cause the bullet to hit the centre. It is obvious that the vertical plane is the important one, for, while there is only one horizontal plane for the eyes, there are always two vertical, that is, in the ordinary position of the body.

We can now go on to discuss for what reasons the "master eye" is so important, and they are shortly these. In all of us one eye is generally

the master, and the muscles of the body learn to adapt their movements to this eye, that is, to work in this "master eye" plane, a fact well shown by the way in which we generally fire a gun from the right shoulder; but it is found that, from several causes, usually fatigue, the "master-eyeship" is not constant for one eye, but is interchangeable.

If the right eye, ordinarily the master, becomes tired, the left eye takes on the duties of the "master eye"; but this throws complicated movements, such as aiming, quite out of gear; for the muscles have long accustomed themselves to act with the right eye as guide, and as we have

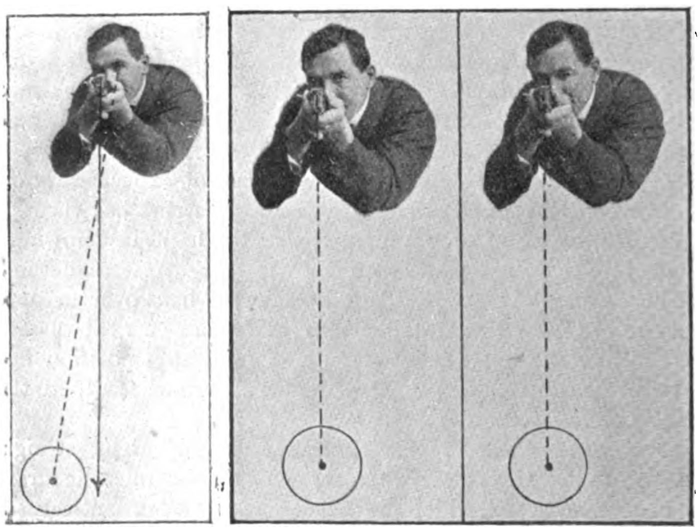

FIG. 9. FIG. 7. FIG. 8.

Fig. 7 shows true aim with a rifle with both eyes open. The line of aim includes the back and fore sights of the rifle and the centre of the target. Fig. 8 shows true aim with the non- "master eye" shut. The shutting of the non- "master eye" makes no difference to the correctness of the line of aim. Fig. 9 shows the error that occurs when the "master eye" is shut (or blocked) and the mind thinks the line of sight and aim is still the same. The line of sight of the non- "master eye" is to the centre of the target, but the line of aim of the rifle is right off the target.

no means of knowing by sight alone which eye is acting as master, they will go on performing their duties as if the message to the brain with regard to the relative location of objects in space had come from the right or original master eye.

Now if we reflect on what has been written with regard to the vertical planes of the master and the secondary eye, it would at first appear that, supposing the secondary eye takes on the mastership, even then the muscles working as for the plane of the usual "master eye" will be working in a parallel vertical plane only $2\frac{1}{2}$ in. from the original "master

eye" plane, so that the error in projection will only be one of $2\frac{1}{2}$ in. on either side of the object. But that far greater confusion arises can be shown by this experiment.

Take a shot-gun, or a stick, and, raising it to the shoulder, aim at some object with both eyes open. Of course, by aiming, the muscles acting in the "master eye" vertical plane have put the "master eye," the gun, and the object all in this same plane.

If the gun be now fired you will hit the object. Without altering your aim or position in any way, shut your "master eye." What does your brain tell you now? What does the message from your secondary

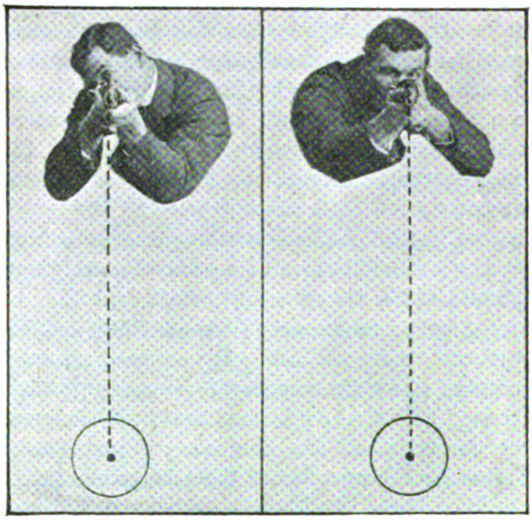

FIG. 10. FIG. 11.

Fig. 10 shows that the aim can still be correct if the non-"master eye" (now artificially made the "master eye" by shutting or blocking the real "master eye") is moved across so as to be in the same straight line, *i.e.*, the same vertical plane as the rifle sights and the object. Fig. 11 shows the same result as fig. 10, obtained by transferring the rifle from the shoulder of the real "master eye" to the shoulder of the artificial "master eye."

eye convey? This, that if the gun were fired you would not go near the object, but somewhere wide to the right or left, for the gun appears to be pointing quite on one side of the direction of the object. Of course, if you move your head so that the secondary eye is exactly behind the sights, you find that the gun is really pointing straight at the object; but the impression experienced in actual fact is one of wide error if for some reason the "master eyeship" be suddenly changed while one is aiming. For the secondary eye, suddenly locating the object, discovers the muscles acting in another vertical plane than its own, *i.e.*, the original "master

eye" plane, and hence the first impression conveyed to the brain is that the muscles are acting all wrong, and in the subsequent mental and muscular confusion the bird is missed, or the batsman bowled, as the case may be. In a great many games with the tiring of the "master eye" and the change of mastership to the secondary, a state of affairs occurs exactly analogous to the above experiment. That erroneous impressions are conveyed, but can be correctly interpreted by the use of common sense or intelligence, is shown below, and this encourages one to think that "master-eyeship" errors could often probably be avoided or correctly interpreted.

They can.

A great difficulty in understanding the points under discussion will be removed if we take care to always realise that what we know of the world outside of our own bodies is the result of subjective impressions conveyed to the brain by the senses of seeing and hearing, etc., and that these impressions are not necessarily true. In fact, did we not use experience, and the reasoning faculties with which it has pleased Nature to invest us, we should be led astray into error by these sense organs of ours every minute of the day.

For instance, we see an explosion take place at a distance, we hear the concussion a few seconds later. If we relied merely on our subjective sensations we should think that the noise and explosion had nothing to do with each other, or we might argue that a thing has to explode some seconds before it can make a noise. By experience, and by using our reasoning powers, we know that neither of these suppositions is correct, but that the noise and the explosion are simultaneous. What has happened is, of course, that the subjective impressions have merely reached our brain at different times because they have travelled by different paths and made use of different special sense organs.

A method of finding out the "master eye" has long been known to gun-makers. They get one to aim at something and notice how one goes about it, and this at once tells them whether the right or left eye is the master. What they really observe is whether the muscles are acting in a right or left master eye vertical plane, but that they have a conception of this plane is very doubtful, and one is led to think that the method has been evolved by rule of thumb. That they find out the "master eye" is certain, but their method does not demonstrate the fact to the owner of the eye so clearly or so certainly as the little experiment at the beginning of this article.

Before proceeding to the practical application of these physiological facts, certain pastimes necessitate the consideration of another factor—motion, and the estimation of the rate of motion—those pastimes in which the objects are moving. We can conveniently subdivide games and sports into two classes on the above basis, namely, those in which the object aimed at remains still, such as billiards, golf, target shooting; and those in which the object moves, such as cricket, tennis, shot-gun shooting.

Now, to be able to hit a moving object we must be able to form an estimate of the speed with which it is travelling, its rate of motion, or, in common parlance, be able to "time" it. There are two ways in which this estimation of the rate of motion is arrived at; one with an optical, and the other with a muscular basis.

The first is dependent on the relative change in size of the projection of the image of an object on the retina; a thing which while it is looked at grows rapidly larger or smaller, we know to be approaching or receding rapidly; but, in the second method, another element comes in which involves a muscular sense, and this brings in a most important factor for error in the actual playing of games; for the impressions which we receive from muscles are notoriously dependent on whether these same muscles are fresh or fatigued.

It is obvious, therefore, that for practical purposes the second method of speed estimation is the more important to us. This estimation is arrived at in the following manner. When the eye gazes at, and focusses, a moving object, to keep this object in the field of vision the eyeball must be turned in the same direction in which the object moves in order to follow it, and it is the amount of work done by the extrinsic or locating muscles of the eyeball which (apart from the change in size of the object already mentioned) gives the brain the clue to the rate at which the object is moving. Thus, if the eye muscles have to move the eyeball quickly we know then that the object gazed at must be moving rapidly, and *vice versâ.* Just such an estimate of exactly the same nature is arrived at roughly by anyone keeping a moving object on the finder of a camera; if the hands have to move the camera rapidly one knows the object is moving rapidly; the way the muscles have to act conveys the impression of rapid speed to our brain. A word as to this so-called nerve muscle sense. It is an impression, received by the brain and conveyed by the nerves running from working muscles, which informs the brain at what rate the muscles are working, and also how much energy they are expending. Similarly we can tell the difference when we lift up with our arms a 2 lb. weight or a 10 lb. weight, and we also know without looking at it whether we are moving it quickly or slowly.

How? By this same nerve muscle sense. But take notice how deceptive this nerve muscle sense is—how much heavier does a bag feel when we have carried it half a mile than when it was lifted from the ground at the beginning of the walk; yet we know that it is exactly the same weight, the seeming increase of weight is merely a subjective impression due to the effect of fatigue; surely a most obvious illustration of the liability of our subjective impressions to error. So, too, with our eye muscles; they also are subject to fatigue, and can lead our brains astray. The batsman, while he is fresh, with his eye muscles unfatigued, can follow the ball with his eye, and can instantaneously impart to the trained muscles of his body the necessary impulses to enable his bat to

strike the ball when he chooses. But observe, after a time his eye muscles become tired; what happens then? To move the eyeball at the same rate as he did at first in following the ball requires an effort; and though a ball may be coming towards him at the same pace as it did at the earlier part of his innings, his eye muscles, fatigued in their effort to keep up with the ball, give his brain an idea of relatively greater speed; his trained muscles obey, as they did when his eye was fresh, and he is inclined to hit at the ball before it has reached hitting distance.

Every day on a cricket field can be seen the unconscious efforts of bowlers to confuse or weary the eye muscles of a batsman who is set. It is quite evident that it is much less of an effort to play bowling which is all the same pace; the eye muscles as each ball comes down do the same amount of work, and give a relatively similar impression; but if balls are bowled at varying paces the eye muscles have constantly to change their rate of contraction, and this not only tends to tire them sooner, but it also tends to confuse by their sending to the brain widely different nerve muscle impulses.

Take cricket, now, for a discussion from the eye-sight point of view, recalling what has been said about the "master eye" and the vertical plane in which the muscles have a tendency to act, and about the estimation of the rate of moving objects with its liability to erroneous impressions. It is of great importance to a batsman to know which is his "master eye," for, owing to the position in which he stands while batting, he is skew-ways-on to the bowler who sends the approaching ball towards him; he has, in fact, to strain the position of his neck so as to turn both eyes directly on to the bowler and the ball which is to be struck, for unless he does so, should his right eye be the master and he bat right-handed, then the bridge of the nose will, intervening, unless he keep his face rigidly turned to the approaching ball, cut off the eyesight of the "master eye," causing the left to take on the mastership, and so get the batsman into all sorts of difficulties. It is convincingly evident on looking at photographs and action photographs of great batsmen that they tend to keep the face square to the ball, and play with the "master eye" and the bat in one vertical plane.

The fact that our two eyes are separated by the bridge of the nose is of curious importance for judging where the ball is when batting. have never heard its importance spoken of, or the importance of the "master eyeship" alluded to, by cricketers, but I have heard some appalling nonsense talked by cricketers about the "blind spot" on the wicket where it is the bowler's ambition to pitch his ball. They do not appear to have the faintest idea that it is a spot which can only exist by the body of the batsman being in such a position that he cannot look directly at the approaching ball, and that as it pitches some portion of his anatomy, generally the bridge of his nose, interposes between his trained localising eye, his "master eye," and the approaching ball. A practical application

of what this teaches us would be, whilst practising batting, occasionally to bandage the secondary eye, so that the trained "master eye" should be taught never to allow itself to be cut off from the ball.

In doing this the head will be found to be forced to turn rather more emphatically in different directions than it was when there was the

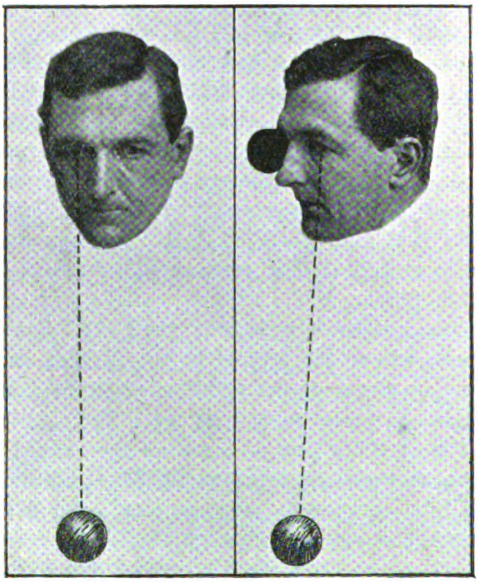

FIG. 12. FIG. 13.

Figs. 12 and 13 show a common, but little known, effect in cricket of not acting in accordance with the true theory of the "master eye." The man to whom the head belongs is supposed to be playing forward to a straight ball pitching on the leg-stump. His stroke and his position are the same in both cases, except that in fig. 12 he has turned his head full face to the ball, so that his "master eye" (the right) gets a full sight of the ball; while in fig. 13 he has kept his head in the position (natural to the novice, but quite fatal), which, since the nose is interposed between the "master eye" and the ball, blocks out the real "master eye" and transfers the aim-sight to the non-"master eye." Until you try, you will be surprised how much the head must be turned to let the "master eye" see the ball. The effect of keeping the head as in fig. 13 is that your hands and bat act as though the line of the right eye were the line of aim, because this is their habit: while really the line of aim is quite different. This is the reason why batsmen so often miss the good-length ball pitching on the leg-stump. They talk of the "blind spot" on the wicket—the blind spot is not a spot at all, it is created by a false line of aim. In fig. 13 you see the ball, but you see it with the wrong eye, the eye which your hand and bat are not accustomed to work with. This counts for at least twenty per cent. of errors of batting.

secondary eye on the other side of the bridge of the nose ready to locate and look at the ball. The conscious or subconscious knowledge that to bat well one must always take care to look squarely at the ball is one of the paths which leads the batsman to become a first-class player—a failure to grasp this fact must have kept hundreds as fourth and fifth-

rate bats, while they possessed all the other essentials, viz., coolness, quickness, swift decision, nimble wrists, &c., to enable them to become first-class. A few hours' batting with the secondary eye intentionally put out of action by bandaging would have let a light into some of these batting failures that would have astounded them. Many a man has become first-class as a bat because he has grasped the necessity of looking straight at the ball; many have missed it by neglecting to do so. Of course, a right-handed batsman with a left "master eye" is anatomically better situated than if he had a right "master eye," for in this case the "master eye" is in front of, and not rather behind, the nose.

If one is tempted to doubt that there be truth in the importance of realising the existence of a raised anatomical separation—the bridge of the nose—between the two eyes, let us turn for a moment to study the relation of this and the "master eye" to hitting a golf ball. We must take as an axiom that the adage, "Keep your eye on the ball," is of vital importance in golf, and that remissness in this particular is fraught with disaster to the player.

To the man who plays right handed, and who has a right "master eye," what happens when this advice is not carried out can at once be rendered apparent by shutting the left eye when swinging with a club at a ball. It will then be found that if, as the club comes up over the right shoulder at the top of the swing, one allows the head to rotate a little in the same direction as the arms are travelling, *i.e.*, from left to right, then suddenly the ball is completely lost to view, the bridge of the nose intervenes between the eye and the golf ball. If now the left eye be opened the ball is again apparent, but what the eye gets is a left or secondary eye impression, and this occurring during an actual swing tends to throw out the muscles and the aim in the manner explained in connection with "master eyeship."

It is very apparent that what actually does happen when the head is allowed to rotate with both eyes open is that a sudden change of mental impression occurs full in the middle of the swing; a left eye impression is substituted for a right. The confusion is feebly and inadequately expressed by the rule-of-thumb man as a state of "not keeping the eye on the ball." There is always in the beginner a tendency to allow the head to rotate in this fashion, partly owing to its going naturally with the swing of the arms and the shoulders, partly to some unconscious effort to give more force to the swing.

A little more lengthy and accurate explanation, such as, "Be careful that in swinging you do not let the direct vision of your 'master eye' be cut off by the bridge of your nose from the ball, and so allow your left eye to assume the mastership," with a few words as to how and why this is important, would surely be fruitful of better results than the mere rule-of-thumb, "Keep your eye on the ball."

A very practical deduction that one arrives at, if it be agreed that

there is reason and truth in the above matter, is that right-handed golfers and cricketers who are by nature left master-eyed, are anatomically thus in a better position to play these games than those who are right-master-eyed, the converse, of course, holding good. Statistics on this point would be very interesting; sufficient to be quoted in this article have not as yet been procured. It has, however, been found that people who are left-"master-eyed" and right-handed are markedly far worse shots in throwing at an object than those who are right-handed and right-eyed. The difficulty is (as with a cricketer and golfer) an anatomical one, it being easier in throwing to work with a right-eye right-hand vertical plane. To return to batting again, it will, as urged above, be more important to the right-handed right-eyed cricketer than to his left-eyed *confrère* to look squarely at the bowler. Try a similar experiment as recommended in swinging the golf club. Stand ready to bat, with the head as it would be in a natural, untrained position, and it will be found at once, by shutting and opening the left eye, that the vision of the right eye scarcely includes the bowler, who can, however, be seen by the left. If this position be retained while playing a ball, it follows that the ball will first be located by the left eye, and as it approaches nearer will come into the range of the right eye, which, if naturally the master, will assume the mastership, and the poor brain will have got both a left and a right eye impression of the approaching sphere, just as happened to the unfortunate golfer who allowed his face to turn and could not keep his "master eye" on the ball; result, in both cases, a certain amount of muscular confusion and possible disaster. It seems reasonable to impress on the right-eyed cricketer the necessity for turning the face square on to the bowler. Looking at the pictures of the great batsmen of the day when ready to face bowling, one is greatly struck by how much the neck is rotated over the advanced shoulder so as to obtain a very front-faced attitude. There seems in this a very practical value in understanding the "master eyeship" in cricket.

Further, a word as to the way in which a knowledge of fatigue in producing erroneous impressions of the pace of balls may be turned to practical use.

It has been shown that with the tiring eye the pace of bowling appears relatively faster; it is then most reasonable in an innings where one finds one is beginning to misjudge balls to play a little slower at them than the mental impression would urge one to do. A practical piece of scientific common sense which might very well make an innings of sixty into one of a hundred. The natural tendency when one is obviously misjudging is to hit quicker than ever, to increase, in fact, the error produced by the mental impression. This is an explanation, of course, which applies to a batsman who has been in some time—long enough, in fact, for eye muscle fatigue to be the probable cause of the erroneous impressions.

Many more applications of the "master eyeship," etc., can be shown to apply to batting, but a relation of them would be tedious, and there is always an inclination in a study of this kind to explain all failures by something to do with the special subjects treated, though there are many factors entering. Besides, once put on the track of the matter, one can deduce the various applications.

However, a short space might be allowed to the bearing of what was called the "master eye" vertical plane, and the tendency the muscles have to bring the striking instrument into this plane; or, shortly, to make the planes of the acting muscles and the "master eye" coincide. It is stated by skilled exponents of cricket that the essential of playing any particular stroke is, first, to get the body into a position which renders the stroke the least constrained and easiest of performance, and then to play the stroke. We will accept this as correct. Now look at some action photographs of strokes being played by great batsmen, and it will at once become evident that beside putting their bodies in the easiest position to perform the stroke with their arms, they have also put their "master eye" in the easiest position for aiming at the approaching ball. That is, the "master eye" vertical plane and the plane of the swing of the bat have been approximately made one. This is very plainly illustrated in leg-glancing and on-and-off driving. Practical deduction—when putting your body in the most comfortable position to play a stroke, see that your "master eye" is as far as possible in such a position as to make your aim as accurate as possible.

Should there be readers of this who still regard vertical planes of muscular actions as myths, surely they would be converted by a short study of fielding. If a ball be thrown into the air, and we stand under it to catch it, and then, when caught, look down at the position of our hands, the centre of them will be found to be in the same vertical plane as one of our eyes, and that our "master eye"; their centre does not coincide with the centre of the body or the mid-point between the eyes. Watch another person take a high catch, and the same conclusion is arrived at. In this case the hands have unconsciously brought themselves into the vertical plane which included the "master eye" and the approaching ball. A practical deduction would seem to be that in fielding a "master eyeship" which remains constant is of importance, and should be cultivated. A tendency to drop high catches from a faulty position of the receiving hands might in some cases be remedied by closing the secondary eye when calculating the catch, and so obviating any "master eye" changing errors.

It is a reasonable conclusion that the popular term, "a good eye," is but a general way of describing a person who possesses a marked "master eyeship" constant to one eye.

Certain it is that many of those who are notoriously possessed of "a bad eye" can be shown to have a "master eyeship" that is easily interchangeable.

To the bowler the fact of a right or left-hand " master eyeship " would not apparently be of such importance, for he goes to his work with his face naturally looking straight towards the batsman, and to the spot on the wicket where he intends to pitch the ball. Herein he has the anatomical advantage of the batsman who is craning his head sideways to see where the ball is coming from.

FIG. 14. FIG. 15.

Figs. 14 and 15 show how the " master eye " theory applies in golf. In fig. 14 the man is addressing the ball for a stroke, drive, approach or putt. He has a full view of the ball with his " master eye," the right. In fig. 15 the man has swung back his club to the top of its swing, and in doing so has made the mistake of turning his head with his shoulders and arms. The result is that the sight of his "master (or real aiming) eye" is blocked out by his nose, and the sight of the ball is limited to the left, *i.e.*, the non-"master eye." Consequently, when he swings down at the ball his club is being guided, not by his "master eye," but by the other. His stroke is sure to be inaccurate, because his hands and arms are not in the habit of working together. Or, to put it another way, the mastership is transferred during the stroke from the real to the artificial "master eye." You address the ball with the right eye as master, and strike it with the left eye acting artificially as master. Therefore the inaccuracy of aim. Hence the dictum in golf, "Keep your eye on the ball," should be " Keep your 'master eye' on the ball."

That the bowler who bowls with a coinciding "master eye" and hand-delivery-vertical-plane keeps a more accurate ball seems probable on the strength of what has been said.

The tendency to error in playing golf by not keeping the eye on the ball, or, as it has been explained above, by an unintentional substitution of one " master eyeship " for the other, only explains one of the eyesight difficulties to be overcome in this most fascinating game. To all who

have played is apparent the great difficulty which actually exists of hitting the ball with a club clean and true, and not topping, schlaffing, or toeing.

In golf (unlike most other pursuits which involve sending something in a desired direction), at the moment of dispatching the object (the ball) towards the flag, the "master eye" vertical plane, in which are included the "master eye" and the ball, is at a right angle to the plane of swing of the hitting instrument and the direction in which it is desired that the ball shall travel. Here, in a word, are explained the reasons of the difficulties and possibly the charm of golf. If it were possible for our muscles to act and the club-head to swing in the same plane as the "master eye," half the difficulties of golf would disappear; as it is, our anatomical construction prevents this, so that golf remains a game in which the travelling club-head must come into the vertical plane of sight at right angles to it; the player derives no assistance from vision for the management of the proper direction and elevation of the travelling club-head, but depends solely on nerve-muscle sense.

Billiards is an admirable game for the illustration of the effect of "master eyeship," and of the tendency there is for muscles to act in what we have called the "master eye" vertical plane. It was, in fact, from this game that the theory of aiming, as put forward in the earlier part of this article, was first deduced. It must always be remembered that what is referred to only applies to the act of aiming, that is, driving the striker's billiard ball exactly against the selected spot on the object ball, and has no reference to side, bottom, or check, or any such technicalities which modify the way in which a stroke is played. In watching a billiard player taking an ordinary half-ball shot one notices several things. First, that the cue in aiming for the stroke is worked backwards and forwards in the same plane as one eye (the master), and that this plane includes the aimed-at spot on the object ball. Unlike a shot with rifle or long-bow (beyond point blank range), elevation does not come into effect for the billiard player, the slate of the billiard-table takes charge of this, so that the player on aiming straight has only to think of the working strength which he wishes to impart to the struck ball; quite enough to concentrate on for most of us who attempt this game. The coincidence of the various factors in the same vertical plane can probably be best observed by getting a player to drive a ball from baulk, say, over the spot, and watching him do this from the bottom of the table. Practical applications could be made somewhat as follows: A beginner should be instructed straight away to put and keep his cue in his "master eye" vertical plane whilst aiming at a ball, and not have to drift into this method, wasting time in harsh experience. The bright light on a billiard-table and the effort of watching the balls is undoubtedly a strain on the eye, and the astonishing way in which one sometimes absolutely misaims a stroke can easily be accounted for by a momentary change in

eye mastership; for exactly the same condition of things can arise as was described to illustrate the momentary mental confusion which can occur when aiming with a gun. It arises from the fact that we have a perception of the cue while we are aiming at a ball, just as we have one of the gun-barrel; the perception of the cue is, of course, more pronounced, because we are aiming at a stationary object. If the "master eye," hand, and cue are all in one plane, well and good; but if for any reason the "master eye" should change, what then? Fallacious impressions are enforced on the brain just as in aiming with a gun. Try this experiment, start aiming to play a ball at a certain spot with both eyes open, be sure of your aim, and then change your "master eyeship" by shutting your real "master eye"; it would now appear to you that you are aiming all crooked until you shift your secondary eye into the same plane as the cue and the ball—absolutely the same conditions are illustrated as were put forward in the gun-aiming experiment. A mastership which remains constant has much to do with correct aiming, and is therefore worth cultivating. So when obviously possessed of a marked tendency to misdirect the playing ball, a tendency many of us at times are subject to, we might well partially or totally close the secondary eye so as to prevent its doing too much in localisation.

In billiards we are always unconsciously thinking of the "master eye" vertical plane in relation to the angle that the played ball or the object ball will make when they impact in the same place. Natural angles are frequently spoken of, but are generally regarded as the angles made by the course of the driven ball and its subsequent deviation after impact; and yet a moment's thought will show that the course taken by the driven ball is really just an expression of the "master-eye" vertical plane; for it is the subjective existence of this plane in the mind which causes the driven ball to subsequently proceed on the course or direction desired.

With regard to shot-gun shooting it was naturally the first pastime to attract the attention of the writer when asked to write on the "master-eye." As mentioned before, the subject has long been recognised by gunmakers, who made a straight or cast-off stock according to whether the mastership be in the right or left eye, provided, of course, the gun be fired from the right shoulder. In investigating the question of "master eyeship" in this kind of shooting a great deal of interesting and practical information was gained. The probable existence of a change of mastership, and the method of describing it, was evolved from the following experience. In a discussion with a man who did a good deal of shooting I was told by him that up to a certain distance he was pretty sure of his shots, in fact, could shoot straight, but beyond this distance he could not hit anything, or, as he described it, he was bound to miss. Investigations of his eyesight appeared likely to bring to light interesting facts—they did. It was found that his right eye, which was the master, was to a certain extent short-sighted (he was quite unaware of this fact until he was tested), but the left eye possessed nearly normal vision.

The whole of his shooting difficulties were then explained right away. His right eye acted as master up to his limit distance of good shooting, but then, beyond this, its lens not being so well adapted for focussing a clear image of the object as that of the left eye, the mastership changed from the right to the left. Thus, without his knowing it, a perfectly erroneous impression was conveyed to him beyond a certain distance. For the nearer shot his muscles had been acting in a right-eye vertical plane, and for far shots there occurred a combination of this with a left-eye impression, a combination which had caused him for years really to aim several feet to the left of anything that he fired at. It is no wonder that he considered himself a bad shot for distant objects. The fact that for near objects the right eye was master, and for far the left, was easily proved by getting him to point quickly at near and far objects, taking note which eye vertical plane his muscles acted in. It was also seen that the distance at which the change of master eyeship occurred coincided accurately with the distance beyond which he said he could not hit anything.

A very practical result followed this discovery. Acting upon advice to try wearing a glass to correct the eyesight of the right eye whilst shooting, so that there should be no need for the left eye to assume the mastership, a marvellous improvement in his shooting occurred, and he became relatively as good a shot at distant objects as he had been at near ones.

There are doubtless numerous similar cases of a disability capable of a like simple and obvious remedy. Although in firing at a moving object one does not gaze along the barrel as in rifle shooting, yet it is impossible to fire a gun from the shoulder without a certain amount of consciousness of how the gun is pointing, because the length of the barrels and the nearness of the gun to the eyes necessitates its coming into the field of vision. Though the most sensitive part of the retina is occupied by the bird, or whatever it may be, the barrels necessarily claim a place on the retina, and having such a place make their presence felt, though perhaps we are unconscious, or only partly conscious, of this. Thus it is in the same way as in billiards, that if the "master eye" be not in the same vertical plane as the barrel, its impression of where the shot will be sent cannot be correctly gauged. An essential of good shooting is to be able to bring a gun up so as to cover exactly the point in space that the direction and rate of flight of the bird require. Hence, as urged before, correct impressions are of primary importance. A man firing in one vertical plane and localising objects with his eyes in another, might just as well shoot with a gun the barrels of which are set on crooked.

It is not contended that a knowledge of "master eyeship" will be a remedy for all bad shots, or for the unskilful exponents of most games —there are so many other factors to be fulfilled in good shooting and skilful playing; but there is no need for people with sound eyes, brain, and limbs to be such poor shots or players as are constantly met with.

Reviews.

THE THEORY AND PRACTICE OF HYGIENE. By Notter and Firth. Revised and largely rewritten by Lieutenant-Colonel R. H. Firth, R.A.M.C. Third Edition. London: J. and A. Churchill, 1908. 993 pp., quarto. Price 21s.

The third edition of this well-known book has been edited by Lieutenant-Colonel Firth. The arrangement of the work has been altered, and sanitary law which in the former editions was dealt with in a separate chapter, has been divided into sections and the legislation bearing on the subject matter has been placed as far as possible at the end of each chapter. The volume under review commences with a general chapter on sanitary law and administration, in which the authorities responsible for the public health are described, then follow the definitions of terms in the various sanitary acts, a consideration of the bye-laws and regulations, &c. While no doubt such a general chapter is necessary in order that the terms used in the legal sections at the end of the various chapters may be understood, it certainly forms a somewhat unattractive introduction to the subject of hygiene, and we fear it will not receive much attention until the general principles have been grasped.

Chapter II. is devoted to the consideration of water. The sections dealing with quantity, sources of supply, storage and purification are but little changed. The chemical processes described under the examination of water are the same as those in the earlier editions. We note that in Kjeldahl's process, 200 cc. of pure sulphuric acid are added to the syrupy residue; obviously 20 cc. must be meant, as the former amount of acid could not possibly be neutralised by the 100 cc. of caustic soda added before commencing the distillation. The microscopical examination of a water sediment is described with considerable detail and some excellent drawings of organisms are given. We agree with the author that the examination of a water sediment has been too much neglected of late. The section devoted to the bacteriological examination has been rewritten, and no attempt is now made to describe the micro-organisms peculiar to water. The qualitative bacteriological examination is limited to the isolation and recognition of sewage and specific microbes. MacConkey's bile-salt medium is suggested for the isolation of *Bacillus coli* and its allies, and the author recommends that gelatine plates should be made with the contents of the tubes showing both acid and gas. We prefer to inoculate the surface of litmus-lactose-agar plates as recommended by the Committee on Water Bacteriology; this method can be used in tropical climates and much time is saved, lactose-fermenting organisms being at once apparent by the change in the colour of the medium. There is an excellent description of *B. coli* and its allies, and a table is given which should greatly facilitate the differentiation of the common fæcal microbes. The most recent methods for the isolation of the *B. typhosus* from water are fully described; we also have found the caffeine process suggested by Hoffman and Ficker to be uncertain in its results.

The hygienic signification of streptococci in water is also considered and a summary is given of the investigations of Andrews and Horder.

We notice that Colonel Firth is indisposed to lay down standards as to the presence of individual bacterial forms in water. It is quite true that local standards arrived at after many analyses and personal investigations of the supplies are of far greater value than general standards. Still, considerable experience has now been accumulated as to the bacteriological contents of surface and deep water supplies in the United Kingdom, and we think that the student will naturally expect in a work of this class an expression of opinion as to numerical standards for *B. coli*, at least, in these classes of water.

Chapters III. and IV. deal with air, ventilation and heating, and much recent work has been added so as to bring the subject-matter well up to date.

Chapter V. has been largely rewritten, and the section on the quantity of food-stuffs required in health is excellent. The work of Attwater, Folin, and Chittenden is discussed, and we quite agree that the evidence does not warrant a permanent reduction of the protein intake for an ordinary man.

The chapters dealing with clothing, exercise and soil appear little changed. There is, however, much additional information in Chapter X. relating to habitations, schools, and hospitals. We consider that the utility of isolation hospitals cannot be questioned, and regard favourably the employment of the cubicle system for the isolation of acute infectious cases. The section on the disposal of sewage contains a good summary of recent biological methods.

Parasites are fully described in Chapter XV. which has been expanded to sixty-one pages. Amongst the arthropoda we find the life-history of ticks given, and descriptions of fleas and blood-sucking flies are also included. Some excellent drawings and beautiful plates, which should greatly assist in the recognition of these parasites, have been added.

The chapter dealing with infectious diseases has been largely rewritten, and recent work on beri-beri, cerebro-spinal fever, diphtheria, dysentery, enteric fever, kala-azar, Malta fever, plague and tuberculosis is fully described. The chapter on disinfection contains much practical information. While agreeing with Colonel Firth that infection pertains more to the clothing and persons of individuals occupying infected rooms than to the floor, walls, and ceiling, we are not prepared to regard the disinfection of exposed surfaces in a room as a farce. In large barrack-rooms it is very difficult to secure adequate disinfection of all the walls, ceilings and floors, but the exposed surfaces in the immediate vicinity of the case can be thoroughly disinfected with a spray, and we think this procedure should never be omitted.

The chapter on vital statistics has been enlarged by the addition of methods indicating the chief sources of fallacy, and sections on frequency curves, correlation, and contingency are given. We fear that most readers will be somewhat discouraged when they open this portion of the volume, and while fully appreciating the labour which has been devoted to its compilation, we think that such intricate calculations could only be made by men who have made a special study of the methods required.

Military hygiene is considered in Chapter XXI., which has been practically rewritten. The sections on the housing of the soldier is excellent, and

contains much new information; illustrations of obsolete types of barracks are given and improvements in construction are traced up to the recent half-battalion barrack design. A short section on the food of the soldier is followed by a discussion of the relative advantages of the bandolier, Aldershot, 1903, and rucksack equipments. Practical hints on the hygiene of the march and of camps are followed by the consideration of the most important problem in military hygiene, viz., how to supply troops in camp, on the march, and on service with a potable water free from pollution. Colonel Firth has devoted much time and labour to this question and the section is worthy of attentive study.

After carefully perusing the volume under review, we consider that it marks a distinct advance on its predecessors, and can confidently recommend it to the officers of the Corps.

W. H. H.

MINOR MALADIES AND THEIR TREATMENT. By Leonard Williams, M.D., M.R.C.P. Second Edition, revised and enlarged. London: Baillière, Tindall and Cox, 1908.

This book consists of lectures delivered at the Medical Graduates' College and Polyclinic. The author states that his object in writing the book has been to supply in an accessible form detailed information on subjects with which the ordinary text-book necessarily deals in a cursory manner. There are nine chapters, dealing not only with all sorts of minor maladies such as colds, coughs, sore-throat, and indigestion, but with general health, insanity, and change of air. The opening page of the book should, when construed into popular language, find a place in every medical officer's lectures on hygiene to troops.

Dr. Williams says: The inflammatory conditions which are liable to affect the upper air passages are usually attributed to inclement weather, and the elements, such as damp, cold and chill, of which such weather is composed. This is a view which is no longer tenable. The person who "caught a chill" and subsequently developed a sore-throat was, although he failed to realise the fact, already infected when he experienced his chilly sensations.

It is necessary to insist upon this view, because the laity clings with great pertinacity to the chill theory, with the result that fresh air, instead of being esteemed as a curative and prophylactic agent, is regarded as the deadliest enemy of the human race, and great vigilance is consequently exercised in excluding it, by every possible means, from houses, public rooms and public conveyances. Until people have become more enlightened, "colds" and their congeners will continue to afflict them with quite unnecessary frequency.

Every chapter in the book is a little mine of information, while the chapter on change of air is quite a compendium of the principles of climatology, as it not only gives the reader the special virtues of most of the spas, but refers him to works where he can obtain fuller information.

Where all is so excellent it is difficult to make a selection, but we like best the chapter on General Health with its trite text from Chaucer:—

"O, wist a man how many maladies
Folwen of excess and of glotonies
He wolde be the more mesurable
Of his diet, sitting at his table."

The book] must, however, be read from cover to cover to be fully appreciated, and we think the time spent in its perusal will not be regretted. It should prove an admirable advertisement for the Polyclinic, as if all the lectures at that institution are so charming and so instructive, one should never miss them when within reach of the Institution.

To use a hackneyed phrase, Dr. Williams' little work "fills a long-felt want," and we suggest that it might well find a place in the library of every military hospital. R. J. B.

A SIMPLE METHOD OF WATER ANALYSIS. By John C. Thresh, M.D. Sixth Edition. London: J. and A. Churchill. Price 2s. 6d. net.

"Good wine needs no bush" is a well-known saying, and it might be modified to read, "A sixth edition requires no review."

The method described in Dr. Thresh's little book has been in use in the Army for several years, and we are glad to learn that it has now been adopted by the Admiralty, and that the requisite reagents and apparatus have been supplied to some hundreds of His Majesty's ships. Not the least valuable portion of the book is a brief but excellent account of the examination of sewage effluents. The author lays clear stress on the oxygen-consuming power of the organic matter in solution, and details a process by which readily comparable results can be obtained.

As Dr. Thresh wisely points out, the difficulty in connection with the examination of a water does not lie in making an analysis, but in interpreting the results obtained.

A careful perusal of the reports on twenty samples of water which are given in this little book should, however, do much to enable a Specialist Sanitary Officer or a Medical Officer of Health to express a reliable opinion on a water supply.

R. J. B.

Current Literature.

The Diagnosis of Enteric Fever.—Francis W. Peabody, in *The Archives of Internal Medicine*, vol. i., No. 2, p. 19, February 10, 1908, describes his method of diagnosing enteric fever by culture from the blood of the ear. Test tubes containing 5 cc. of fresh ox-bile are sterilised in the autoclave. The lobe of the ear is cleansed with alcohol and sterile gauze and is pricked with a lancet-pointed needle. Blood is squeezed out and allowed to run into the tubes, not more than 2·5 cc. of blood to 5 cc. of bile. Incubate at 37° C. for fifteen hours, then inoculate congulated blood serum with several loopfuls of the mixture, incubate for three or five hours, and make subcultures on agar. The purpose of making a culture on blood serum is to eliminate any skin cocci which may have contaminated the blood withdrawn from the ear, for on this medium the typhoid bacillus rapidly outgrows other bacteria. The author identifies any Gram-negative bacillus thus isolated by growing it on glucose agar, in litmus milk, and by testing its agglutination with anti-typhoid serum. He notes, however, that freshly isolated growths are sometimes non-agglutinable. He obtained positive results in all of five cases examined

during the first week, in 79 per cent. of nineteen in the second week, and in 44 per cent. of nine in the third and fourth weeks. In nine the successful culture preceded a positive Widal reaction by three to seven days. In one instance an agglutination was never observed throughout the course of the fever. C. BIRT.

Mosquito Traps.—In the *Bulletin de la Société de Pathologie Exotique* for February, 1908, Médecin Major G. Blin describes a method by which the numbers of mosquitoes in the neighbourhood of houses in the town of Cotonou, French Guinea, were greatly reduced. The method in question consists in catching mosquitoes in "hole-traps" (*trous-pièges*), and subsequently burning them. Holes about the diameter of large rat-holes are dug with a special narrow, rectangular-bladed spade, to a depth of 18 inches. The direction of the hole-trap should be very oblique to the ground-level, its orifice turned directly away from the prevailing wind and opening perpendicular to the direction of the rays of the sun. The holes should be made at intervals of from fifteen to twenty yards.

One must be careful not to walk over the hole-traps, as the slightest disturbance of the soil frightens the mosquitoes out. In dry weather a hole-trap will last eight or ten days. The mosquitoes enter the traps in the morning before 9 a.m., and do not begin to emerge again until 3 p.m. Accordingly, between these hours the mosquitoes which have taken refuge from the sun in the hole-traps can be destroyed by inserting in the holes a burning torch made by lighting a slip of wood soaked in petroleum.

Mosquitoes may be caught for purposes of collection and identification in wide-mouthed jars, the orifices of which are fitted with a reversed cone of gauze. They are subsequently killed by placing in the jar a ball of cotton-wool soaked in chloroform.

By means of the hole-traps the author estimates that some 35,000 mosquitoes (*Stegomyia* and *Anopheles*) were killed during the first fortnight. By the end of a month the numbers of the insects in the town had diminished so markedly that Europeans were able to sleep without mosquito curtains. Previously the white population had been in the habit of sitting down to dinner with their lower extremities enveloped in sacks, as the only means of escaping being bitten.

A. I. FORTESCUE.

The Significance of Tubercle Bacilli in the Fæces.—Randle C. Rosenberger has examined the alvine evacuations of 672 individuals, and has detected the tubercle bacillus in 120, or 19·6 per cent. His report is published in the *Proceedings of the Pathological Society of Philadelphia*, new series, vol. xi., No. 2, February, 1908, p. 29. Sixty of the 672 persons were diagnosed tubercle. He detected the tubercle bacillus in all. His technique is simple. A small particle of fæces is spread on a slide, which he then stains in the usual manner. He admits he has been occupied from one to two hours in detecting two or three bacilli. He concludes: (1) No other acid-fast bacillus was found in the fæces but tubercle bacillus. (2) The presence of the tubercle bacillus in the fæces means that active tuberculosis exists somewhere in the economy. (3) In acute miliary tuberculosis the bacillus is always present in the fæces. (4) In all cases of chronic diarrhœa and in cases of general

glandular involvement the fæces should be searched for tubercle bacilli. (5) The finding of tubercle bacilli does not mean intestinal ulceration in all cases. (6) In arrested or healed pulmonary tuberculosis no tubercle bacilli are found in the sputum or fæces. (7) The fæces should be studied for tubercle bacilli as a part of routine examination, especially in suggestive cases when no expectoration can be obtained. (8) In the bile of seventeen tuberculous patients tubercle bacilli were not found.

C. Birt.

Correspondence.

WHEN SHOULD MERCURY BE GIVEN FOR SYPHILIS?

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—With reference to Major Porter's letter in the April number of the Journal, in which he says: "A typical Hunterian chancre is very seldom seen nowadays, and secondary symptoms more often follow what was apparently a non-infective sore," I would like to point out that, in my experience, the exact opposite is the case.

The chief characteristic of a Hunterian chancre is the induration, which is usually of cartilaginous hardness, and this I find is the rule rather than the exception in those cases which subsequently develop syphilis. This hardness cannot be judged by merely looking at the sore, *but must be felt with the fingers* to be properly appreciated.

I recently had charge of a ward with ten beds which was supposed to contain cases of soft chancre only, but on examining the sores I found that seven of the ten patients had typical Hunterian chancres, and in several cases the sores were so hard that they felt like a piece of bone under the skin. Up to the date of writing, six of these cases have developed typical secondary symptoms, and I have not the least doubt that the seventh will do the same.

I am not in medical charge of venereal wards now, and cannot give larger figures, but I feel certain from previous experience, that fully 80 per cent. of cases which subsequently develop secondary syphilis have had *hard* chancres; and 50 per cent. of these might be called typical Hunterian chancres. I am aware (as has been pointed out by Lieutenant-Colonel T. Du B. Whaite) that a primary syphilitic sore on the glans penis may have little or no induration, but the glans is not the most common site for these sores.

I am, &c.,

J. J. W. Prescott,
Captain, R.A.M.C.

Royal Military Infirmary, Dublin,
April 10th, 1908.

Paste 14p

THE ADVENT OF CRAW-CRAW IN THE ANGLO-EGYPTIAN SOUDAN.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—In the note to his paper under the above heading in your February number Captain Ensor states that he discovered a diplococcus in his last case of the disease in addition to staphylococci. This is interesting in view of the close similarity noted by Sir Patrick Manson between craw-craw affections and veld sores, in connection with which latter ailment Professor Ogston, of Aberdeen, has described a diplococcus arranged in pairs like a gonococcus (*Micrococcus campaneus*), and Mr. Harman also found diplococcus (*Micrococcus vesicans*). Can these be identical with Captain Ensor's diplococcus, or are they all attenuated forms of staphylococci?

I am, &c.,
E. B. Steel,
Major, R.A.M.C.

Nasirabad,
March 19*th*, 1908.

POISONING WITH CHROME-YELLOW.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—I should like to ask if any of our officers in medical charge of cavalry, artillery or other units which use "chrome-yellow" for cleaning their yellow braid and facings, have ever noticed signs of lead poisoning from the use of this substance, which is simply powdered chromate of lead?

This chrome-yellow is, or used to be, mixed with water, freely applied to the braid to be cleaned, allowed to dry, and then the surplus removed by vigorous brushing; and in a Hussar regiment, of which I was in medical charge some years ago, I had several cases of what I took to be mild lead poisoning, which I attributed to the introduction into the system of lead in this form, either from the men eating their bread after using the "chrome-yellow" without washing their hands, or inhaling the dust while brushing their clothes.

I have never met any officer of the Corps who has corroborated my impressions on this matter; but I remember being told that frequently the barrack-rooms of the particular regiment I refer to were filled with a regular yellow fog from this chrome dust. That lead poisoning may be caused by inhaling powdered compounds of lead I had abundant evidence of when in medical charge of Woolwich Arsenal, where some of our worst cases of plumbism were seen among men engaged in removing

the red paint from canisters in which old ammunition had been returned from abroad.

It might be interesting and useful to know the experience of officers of our Corps in this matter.

I am, &c.,
J. R. Dodd,
Lieutenant-Colonel, R.A.M.C.

Victoria Barracks, Belfast,
April 23rd, 1908.

SYPHILIS IN THE ARMY.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—I would feel obliged by your kindly inserting my reply to a letter, on p. 568 of the last number of the Corps Journal, from Colonel F. J. Lambkin, R.A.M.C.

I am at a loss to understand Colonel Lambkin's letter. In the Second Report of the Advisory Board on the "Treatment of Venereal Diseases in the Army," p. 56, a definite question was asked by that Board, namely, Question VIII.: "What advantages may be expected from treatment by other methods than by the use of mercury and the iodides? Colonel Lambkin, on p. 56, last two lines of the above Report, gave the following answer: "No advantages may be expected from other modes of treatment without mercury." He did not qualify his answer in the least.

On p. 52, lines 3 and 4, of my book "Syphilis in the Army" (John Bale, Sons and Danielsson, 1907), I wrote: "I do not concur in the opinion expressed by Colonel Lambkin that no advantage may be expected from other modes of treatment without mercury." The statement in my book, therefore, is absolutely correct, and I did not attribute to Colonel Lambkin, as stated in his letter, "an opinion which he never held."

Woolwich,
May 14th, 1908.

I am, &c.,
H. C. French,
Major, R.A.M.C.

INDEX TO VOLUME X.

48

Hutton J. A. Surgeon Major
Life of — 205

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

MAY, 1908.

ARMY MEDICAL SERVICE.—GAZETTE NOTIFICATIONS.

Lieutenant-Colonel Alan E. Tate, R.A.M.C., to be a Deputy Assistant-Director-General at Headquarters, *vice* Lieutenant-Colonel M. W. Russell, R.A.M.C., dated April 1, 1908.

Lieutenant-Colonel Michael W. Kerin, from the Royal Army Medical Corps, to be Colonel, *vice* J. McNamara, M.D., dated March 29, 1908.

Colonel James McNamara, M.D., is placed on retired pay, dated March 29, 1908. He entered the Service on April 1, 1871, was promoted Surgeon, Army Medical Department, March 1, 1873; Surgeon-Major, Army Medical Department, April 1, 1883; Surgeon-Lieutenant-Colonel, A.M.S., April 1, 1891; Brigade-Surgeon-Lieutenant-Colonel, A.M.S., July 9, 1895; Colonel, Royal Army Medical Corps, July 4, 1900. His war services are as follows: Perak Expedition, 1874.—Was present at attack and capture of Kopayang Stockades. Medal with clasp. Afghan War, 1878—80.—Covering the retreat from Maiwand, Siege of Kandahar and Battle of September 1. Despatches, *London Gazette*, December 3, 1880. Medal with clasp. Egyptian Expedition, 1884.—Soudan, Battles of El Teb and Tamai; mentioned in Despatches. Medal with clasp; bronze star.

ROYAL ARMY MEDICAL CORPS.

Lieutenant-Colonel Charles W. Thiele, M.B., retires on retired pay, dated March 21, 1908. He entered the Service July 30, 1881, was promoted Surgeon-Major, Army Medical Service, July 30, 1893, Lieutenant-Colonel, Royal Army Medical Corps, July 30, 1901. His war services are as follows: South African War, 1899—1902.—Relief of Ladysmith, including action at Colenso. Operations on Tugela Heights (February 14 to 27, 1900), and action at Pieters Hill. Operations in the Transvaal, West of Pretoria, July to November 29, 1900. Operations in Orange River Colony, May and June, 1900. Operations in Transvaal, November 30, 1900, to May 31, 1902. Queen's Medal with 5 clasps; King's Medal with 2 clasps.

Lieutenant-Colonel Delaware L. Irvine is placed on retired pay, dated March 28, 1908. He entered the Service July 31, 1880, was promoted Surgeon-Major, Army Medical Service, July 31, 1892; Lieutenant-Colonel, Royal Army Medical Corps, July 31, 1900. His war services are as follows: Soudan Expedition 1884-5.—Nile, action of Kirbekan. Medal with 2 clasps; bronze star. South African War, 1899-1900.—Relief of Kimberley. Operations in the Orange Free State, February to May, 1900; including operations at Paardeberg, February 17 to 26. Actions at Poplar Grove and Driefontein. Operations in the Transvaal, in May and June, 1900, including actions near Johannesburg, Pretoria and Diamond Hill (June 11 and 12). Operations in Cape Colony, South of Orange River, 1899-1900; including actions at Colesberg (January 1 to February 2). Queen's Medal with 5 clasps.

EXAMINATION RESULTS.

In the report on the examination held in November, 1907, of officers of the Regular Forces, &c., the following remarks are made on officers of the Royal Army Medical Corps.

(*d*) *ii* "Military Law." The best papers, gaining 175 marks and over, out of a total of 200, were sent in by: . . . Lieutenant J. A. Anderson, M.B., R.A.M.C. . .

(*h*) *ii* and *iii* Royal Army Medical Corps Subjects: Lieutenants W. R. Galwey, M.B., and R. G. H. Tate, M.D., R.A.M.C. submitted especially good work.

Appendix VIIIB. King's Regulations (Majors of the Royal Army Medical Corps), Sanitation and Epidemiology. "One candidate, Major J. G. McNaught, M.D., possesses, in marked contradistinction to the rest, not only ample knowledge, but a clear and logical method of setting it forth."

DIPLOMAS.—Lieutenant-Colonel G. Scott, M.B. (retired), has obtained the Diploma of Public Health, Aberdeen. Major G. W. Tate, Diploma of Tropical Medicine of Liverpool University.

POSTINGS.—Aldershot Command: Captain R. F. M. Fawcett. Eastern Command: Colonel J. C. Dorman, C.M.G., and Lieutenant-Colonel E. L. Maunsell. Irish Command: Captain T. F. Ritchie. Southern Command: Colonel M. W. Kerin. Scottish Command: Major B. H. Scott and Captain H. C. Sidgwick. Western Command: Captain J. F. Whelan.

APPOINTMENTS.—Colonel M. W. Kerin, as Administrative Medical Officer at Tidworth. Colonel J. C. Dorman, C.M.G., as Principal Medical Officer, Eastern Command. Lieutenant-Colonel E. L. Maunsell, charge of Military Hospital, Colchester. Major B. H. Scott, Medical Inspector of Recruits, Scottish Command. Major A. C. Fox, Specialist in Midwifery and Gynæcology at Tidworth. Major F. M. Mangin, Specialist in Ophthalmology, Aldershot Command. Major O. L. Robinson, Secretary and Registrar, Royal Victoria Hospital, Netley. Captain F. W. Lambelle, Specialist in Operative Surgery, Northern Command. Captain E. Brodribb, Specialist in Ophthalmology at Shorncliffe. Lieutenant-Colonel H. E. R. James (retired) has been appointed an Instructor, under the General Staff, to the Officers' Training Corps.

ARRIVALS HOME.—From India: Colonel M. W. Kerin, Major B. H. Scott, Captains J. F. Whelan and T. F. Ritchie. From South Africa: Colonel J. C. Dorman, C.M.G., Lieutenant-Colonel E. L. Maunsell. From Mauritius: Major C. E. P. Fowler.

ARRIVALS HOME ON LEAVE.—From India: Lieutenant-Colonels D. M. O'Callaghan and A. R. Aldridge; Colonel F. B. Maclean; Majors L. A. Mitchell and J. B. Anderson; Captains H. O. M. Beadnell, J. M. H. Conway, H. E. M. Douglas, V.C., D.S.O., A. O. B. Wroughton, A. B. Smallman, T. E. Harty: Lieutenant T. S. Blackwell. From South Africa: Lieutenant-Colonel W. Heffernan, Majors J. R. McMunn and J. E. Carter, Captains E. H. M. Moore and J. T. McEntire. From Egypt: Lieutenant J. M. B. Rahilly. From Bermuda: Lieutenant A. M. Rose.

SELECTIONS FOR INCREASED PAY.—Lieutenant-Colonels A. F. Russell, C.M.G., and M. W. Pike, D.S.O., have been selected for increased pay of that rank.

TRANSFERS.—Captain E. Brodribb, from Scottish Command to Shorncliffe, and Captain F. A. Stephens, from Scottish Command to Birmingham.

EXCHANGES.—Majors C. B. Martin and S. H. Withers.

The names of Major R. J. Blackham, W. W. O. Beveridge, D.S.O., and Captain H. C. Sidgwick are added to the list of officers probably proceeding abroad next season.

The names of Captains G. Baillie and B. B. Burke are added to the list of officers for the next College Course, *vice* Captain T. H. Stevenson, deceased, and Captain J. P. J. Murphy, not available.

The names of Captains L. F. F. Winslow and A. J. Williamson are added to the "waiting" list.

DEATHS.—STEVENSON.—On March 21, 1908, at Royal Herbert Hospital, Woolwich, Captain Thomas Herbert Stevenson, M.B., R.A.M.C., aged 35. He entered the Service April 25, 1900, was promoted Captain, Royal Army Medical Corps, April 25, 1903. His war services are as follows: Tibet, 1903-4. Medal.

Entry put here instead of on page 124

MOORE.—On March 24, 1908, at Wellington, Somerset, Colonel Joseph Henry Moore, retired pay, late R.A.M.C., aged 63. He entered the Service April 1, 1867, was promoted Surgeon, Army Medical Department, March 1, 1873; Surgeon-Major, Army Medical Department, April 1, 1879; Surgeon-Lieutenant-Colonel, Army Medical Service, April 1, 1887; Brigade-Surgeon-Lieutenant-Colonel, Army Medical Service, April 26, 1893; Surgeon-Colonel Army Medical Service, June 13, 1898. Retired, January 15, 1902. His war services are as follows: Ashanti War, 1873-4.—Defence of the Hospital at Foomanah. Medal with clasp. Afghan War, 1878-9.—Occupation of Kandahar and Khelat-i-Ghilzai, actions of Ahmed Khel and Urzoo. Mentioned in Despatches. Medal with clasp.

FOX.—On March 28, 1908, at Rochester, Kent, Surgeon-General Thomas William Fox, M.B., retired pay, aged 77. He entered the Service July 5, 1852, was promoted Assistant Surgeon, Staff, July 23, 1852; Surgeon, Staff, September 18, 1860; Surgeon-Major, July 5, 1872; Brigade-Surgeon, Army Medical Department, November 27, 1879; Deputy-Surgeon-General, June 23, 1880; Surgeon-General, May 18, 1887. Retired, February 15, 1888. His war services are as follows: Persian Expedition, 1857, with 14th Light Dragoons at bombardment of Mohumrah. Medal with clasp.

BATHO.—On April 3, 1908, at Sydenham, Colonel Robert Batho, M.D. (retired pay), aged 70. He entered the Service April 1, 1861; was promoted Surgeon, Army Medical Department, March 1, 1873; Surgeon-Major, Army Medical Department, April 1, 1876; Retired Pay, with honorary rank of Brigade-Surgeon, September 16, 1882; Colonel, Royal Army Medical Corps (retired pay), October 18, 1902.

QUARTERMASTERS.—Quartermaster and Honorary Captain A. Finley placed on retired pay, March 18, 1908.

Serjeant-Major J. W. Osborne to be Quartermaster, with the honorary rank of Lieutenant, *vice* Honorary Captain A. Finley, dated March 18, 1908.

The dates of arrival home of Quartermasters H. Woolley and G. L. Allen should read March 9, 1908, and for Quartermaster G. F. Short, March 11, 1908, and not as stated in the April Journal.

Quartermaster and Honorary Captain J. B. Short has been awarded the certificate for proficiency in Sick Cookery, after examination by the "Universal Cookery and Food Association."

LIST OF CASUALTIES:—

Discharges. — 5843 Serjeant-Major Crichton, April 5, 1908; 7700 Staff-Serjeant J. S. Chilvers, March 18, 1908, termination of second period; 7649 Staff-Serjeant J. Leonard, March 30, 1908, after three months' notice; 7697 Serjeant A. Campell, March 17, 1908, termination of second period; 16043 Corporal A. Peters, March 12, 1908, medically unfit; 12299 Corporal T. Carbury, March 25, 1908, termination of second period; 7906 Corporal J. Tuohy, March 31, 1908, after three months' notice; 8982 Corporal F. O. Light, March 31, 1908, medically unfit; 19500 Private C. Hudson, March 19, 1908, medically unfit; 16422 Private L. A. Quin, March 23, 1908, medically unfit; 589 Boy A. J. A. Steggles, March 23, 1908, medically unfit; 1550 Private W. Walker, March 24, 1908, misstatement as to age; 1496 Private H. Newcombe, March 25, 1908, free under Art. 1058, iii., Pay Warrant; 1770 Private W. Smith, February 17, 1908, on payment of £10.

Transfers from other Corps.—1717 Private H. Emment, from Royal Field Artillery; 1736 Private G. Topham, from Sherwood Foresters; 1737 Private R. Glenton, from Gordon Highlanders; 1755 Private J. Snedden, from Argyll and Sutherland Highlanders; 1756 Private F. P. Connolly, from Loyal North Lancashire Regiment; 1775 Private W. Dolan, from Irish Guards; 1776 Private J. Rollo, from Army Service Corps.

Transferred to Army Reserve.—13211 Corporal W. G. Clement, 13773 Corporal G. F. Bower, 13927 Corporal T. C. Wallace, 13193 Lance-Corporal W. McFadden, 13212 Lance-Corporal J. Brown, 13772 Lance-Corporal M. Penney, 18494 Lance-Corporal J. L. Major, 13229 Private W. G. H. Stiles, 18278 Private W. Watts, 13176 Private A. B. Walls, 13178 Private A. Jolley, 18009 Private J. Wright, 18813 Private W. Gaffney, 13309 Private C. Haines, 13189 Private C. G. T. Clarke, 13395 Private A. F. Edwards, 19588 Private G. Pierce, 13440 Private J. T. Bloxham, 14058 Private W. Boyle, 13442 Private T. Veighley, 13443 Private E. Lawry, 13445 Private G. H. Wicks, 13459 Private L. Johnston, 15797 Private G. Moore, 17909 Private J. Brown, 19590 Private J. J. Walmesley, 13628 Private W. R. Wathen, 13662 Private

W. Gunn, 409 Private G. C. Pearce, 15093 Private G. H. Harris, 13886 Private W. Lambourne, 19599 Private A. E. Minns, 13925 Private F. W. Eldrett, 13922 Private W. Lacey, 14022 Private D. Sullivan.

Transferred to other Corps.—11523 Serjeant H. Shaw, to Glasgow Companies Royal Army Medical Corps Volunteers; 11504 Serjeant P. O'Flynn, to 2nd Life Guards; 1433 Private W. Hillier, to Royal Engineers; 11779 Serjeant G. Neenan, to Colonial Government, Uganda.

Deaths.—8485 Serjeant H. J. Reid, H.T. "Sicilia," at sea; 12443 Serjeant H. G. Burns, Tientsin; 1536 Private W. J. Hathway, Aldershot; 18994 Private A. Maltby, Wynberg, C.C.

Embarkations for Abroad.—To Gibraltar, per s.s. "Menepthah," March 10, 1908.—10510 Staff-Serjeant W. T. Eldergill, 18577 Corporal F. L. Read, 862 Private J. Gale, 9884 Private M. Corbett, 844 Private B. D. Johnstone, 19402 Private G. Marsh, 233 Private C. Allen, 18200 Private W. G. Collings, 590 Private F. C. Gilbert, 986 Private A. F. Godfrey, 19652 Private C. V. Jefford, 19291 Private G. Lauraine, 9815 Private A. Leaf, 925 Private C. Lomas, 560 Private F. J. Norris, 267 Private A. E. Scammell, 18196 Private J. J. White.

To North China, per s.s. "Sumatra," March 14, 1908.—8977 Serjeant J. Sallis, 19468 Private G. D. Jack, 678 Private L. Reed, 152 Private W. H. Taylor, 796 Private A. Tingley.

To Bermuda, per s.s. "Port Kingston," April 4, 1908.—6799 Serjeant-Major A. Harwood.

Disembarkations from Abroad.—From South Africa, per s.s. "Braemar Castle," March 30, 1908.—15196 Corporal C. T. Pepper, 15776 Corporal H. G. Blackman, 14569 Lance-Corporal T. Littleworth, 16247 Lance-Corporal E. S. Freeman, 16764 Private J. Abraham, 16742 Private W. Burns, 19016 Private J. Claxton, 11197 Private F. A. Cook, 16317 Private S. Davenport, 16850 Private W. J. Denning, 15577 Private G. W. Fox, 14452 Private F. Godfrey, 9757 Private C. Hayes, 15951 Private C. A. James, 16669 Private A. Lloyd, 18993 Private E. P. T. Morris, 15904 Private A. Seeley, 14558 T. W. Sumpter, 14767 Private W. Wills, 12117 Private F. J. Ashby, 17890 Private R. Costigan, 16674 Private J. Dunn.

Promotions.—5743 Serjeant-Major J. W. Osborne, March 18, 1908, to H.M. Commission; 7288 Quartermaster-Serjeant W. J. Dudman, March 18, 1908, Serjeant-Major, *vice* Osborne.

THE FOLLOWING N.C.O.'S AND MEN HAVE QUALIFIED FOR PROMOTION IN THE VARIOUS CORPS EXAMINATIONS.

For Quartermaster-Serjeant.—10162 Staff-Serjeant C. Drury, 9936 Staff-Serjeant H. Allwork.

For Staff-Serjeant.—7850 Staff-Serjeant J. Carroll, 15721 Serjeant A. E. Odell, 10442 Serjeant C. Dunglison.

For Serjeant.—10162 Staff-Serjeant C. Drury, 15577 Corporal D. Russell, 5795 Serjeant O. Ford, 14770 Corporal A. Buckner, 18728 Corporal J. R. Cole, 15288 Corporal W. C. Prince, 18976 Corporal E. G. Robinson.

For Corporal.—12088 Private G. Wells, 15981 Private R. Hayes, 16069 Private A. Alderton, 19280 Private E. Clarke, 18418 Private G. Smith, 19466 Private T. Daly, 18029 Private A. L. Burr, 18083 Private J. Gleave, 19170 Private A. G. Jessop, 12756 Private F. H. Jones, 16982 Private J. Medland, 17598 Private W. Sparks, 16447 Private J. W. Ashworth.

NOTES FROM BLOEMFONTEIN.—Sergeant W. H. Way, R.A.M.C., writes: "The cricket season is just over and our team, materially strengthened by some new blood from home, has done very well, winding up the season with the following analysis:—

Played	Won	Lost	Drawn
17	9	6	2

"Though the figures do not represent us in any too strong a light, we have the satisfaction of having accounted for every team in the garrison, among them such 'crack' combinations as the Dragoons, the Hampshires and the Welsh Regiment, while towards the close of the season we became quite invincible and gained four brilliant victories 'right off the reel.'

"Our success is mainly due to the excellent all-round work of Corporal Stroud, who heads both batting and bowling averages, but who, we are very sorry to say, has just left us for Pretoria. Walton, our 'Jessop,' has been making some more huge scores in very little time, and in recognition of his consistent good play was presented with a bat from our Commanding Officer. Among the new blood, we possess a very clever bowler in the person of Lance-Corporal Mayman, who has had not a little to do with our success this season and of whom we hope to hear more in the future.

"While the season was in full swing we were deprived of the services of our worthy Captain, Major Clarke, who has gone on a well-earned holiday to Australia, but his place was ably filled by Lieutenant R. P. Lewis, who in addition to being a fine sportsman, is developing into a dangerous fast bowler, with a particular weakness for sending down a ball which in cricketing parlance 'comes in very quickly from the off.'

"As a fitting finale to the season, a match was arranged between the officers and Senior N.C.O.'s and the 'Rank and File.' The former batted first and compiled the good total of 98, to which Lieutenant Bryden contributed a hard hit 27, while Captain Fawcett and Serjeants Page, Way, and Jones all got into double figures. Against this total their opponents could do little, and owing to some fine bowling by Lieutenant Lewis and Serjeant Jones, who were well 'on the spot,' they were all dismissed for the paltry total of 41, Muir and Lovett being the only two to reach double figures. We append the averages for the season."

Batting Averages.

	Innings	Highest score	Not out	Runs	Average
Corporal Stroud	19	106*	5	562	40·14
Private Walton	17	88	2	466	31·06
,, Lovett	9	28	2	85	12·14
,, Miles	7	19	1	76	12·6
Lieut. V. H. Symons	8	37	0	75	9·37
Major S. F. Clarke	7	16	1	53	9
Private Hedges	12	19	1	99	9
,, Baxter	16	24	3	91	7
Lieut. R. A. Bryden	9	27	0	58	6·44
Private Mulley	12	14*	4	50	6·25
Lieut. R. P. Lewis	9	7	0	31	3·44

* Not out.

Bowling Averages.

	Overs	Maidens	Runs	Wickets	Average
Corporal Stroud	202	24	657	92	7·14
Lieut. R. P. Lewis	38	2	113	11	10·27
Lance-Corpl. Mayman	126	14	384	36	10·66
Major S. F. Clarke	73	9	276	19	14·52

NOTES FROM DARTFORD.—Captain J. P. Ekins, R.A.M.C.V., sends us the following:—

"A COMMEMORATION TABLET TO ROYAL ARMY MEDICAL CORPS VOLUNTEERS.

"At the final parade of the Dartford Detachment of the Royal Army Medical Corps (Volunteers) as 'Volunteers,' on Saturday, April 4, a commemoration tablet, bearing the names of the members of the Detachment who served in South Africa during the war, was unveiled by Mr. Councillor A. J. Penney, J.P., chairman of the Dartford Urban District Council, in the lecture room of headquarters, Spital Street. Townspeople interested in the welfare of the Corps were invited to witness the ceremony, and amongst those attending were—Mr. Councillor W. J. Davis, vice-Chairman of the Council; Mr. Councillor W. E. Goff, Lieutenant J. Harston (Dartford Detachment of Volunteers), Mr. E. W. Snowden, &c. Members of the detachment paraded in strong force, under the command of Captain J. Parker Ekins, and the proceedings, though brief, will long be remembered by the medicos after they have become part and parcel of the new Territorial Army.

"Mr. Councillor Penney, J.P., pulled the cord, releasing the Union Jack with which the tablet was covered, and, in so doing, said it gave him very much pleasure to unveil that tablet in commemoration of those members of the Dartford Detachment who served in the South African war.

"The unveiling having been performed, the Dartford Town Prize Band played the 'National Anthem,' and Captain Ekins afterwards explained that the Detachment sent out one officer and forty-four men, which was very creditable for a town like Dartford. He was very pleased indeed to state that they all returned, except one man, Private A. Paulling, who lost his life at Kronstadt, in July, 1902. He was quite sure that if the country ever needed the Territorialists in the future they would be quite prepared, as they were during the late war, to give their services to their King and country.

"Bugler Corporal Perryman then sounded the 'Last Post.'

"Mr. Penney, in a brief address, said he felt they owed a deep debt of gratitude to those men who went forth to South Africa. It was indeed very noble and brave of them to leave their homes, friends and employment to go forth at the call of duty. They were very glad to know that, with the exception of one, they all returned. It was with a view of perpetuating, and handing on to the future, the names of those who so bravely went forth, that that tablet was unveiled that day. That day they paraded for the last time as Volunteers, but, whatever changes there were in the future, he was sure they all hoped this Territorial Army scheme would be the means of strengthening the forces of their country. It might be, perhaps, to some of them a little inconvenient that changes should be made, but still, there were times when changes were necessary, and they sincerely hoped this change would be for the best, and that they would see an army better equipped in every respect, better armed, and able to parade in greater strength in the future than in the past.

"At the conclusion of the proceedings three cheers were raised for Mr. Penney and another for Captain Ekins.

"Staff-Serjeant French was present in his official capacity, and Staff-Serjeant Murray, the former instructor attached to the Detachment, also attended.

"The tablet, which is of artistic design, is emblazoned with the Corps crest, and at each bottom corner is designed the familiar red cross. Following the lettering 'South Africa, 1900—1902,' are the names of the members of the Detachment who served, tabulated in the following order:—

Captain M. Taylor.	Private F. Martin.	Private L. Haysom.
Private W. R. Bond.	Private J. Mayger.	Private L. Hollands.
Dr. A. Fisher.	Corporal H. L. Rogers.	Private L. Jarvis.
Private R. Hall.	Private P. Tapley.	Private J. May.
Corporal H. Leggatt.	Private W. G. Lambkin.	Private W. H. Stanley.
Dr. R. Reynolds.	Private E. F. Saxton.	Private G. F. Troke.
Dr. A. Rowe.	Private F. Sharp.	Private E. Cuckow.
Corporal J. E. Wise.	Private A. Moody.	Private W. Euridge.
Private T. Bates.	Private G. W. Smith.	Private G. Golding.
Private H. Black.	Dr. G. D. Weatherall.	Private A. Goodhew.
Private C. Bryant.	Private A. Goldsmith.	Private H. Lane.
Private A. Chalcraft.	Private C. W. Brookson.	Private J. R. Mockridge.
Private E. W. Cuckow.	Dr. A. E. Cook.	Private G. Quinton.
Private C. Dodd.	Dr. H. L. Frisby.	Private W. Wellard.
Private P. Loveland.	Private W. Gallier.	

Private A. Paulling, died Kronstadt, July, 1902.

"The tablet also recorded the numbers of the men, and dates on which they accepted active service."

NOTES FROM CAIRO, EGYPT.—Lieutenant G. W. Heron, R.A.M.C., writes (March, 1908): "During the last month many inspections have occurred, and we have emerged scatheless, apparently, from all these trials, and have again resumed our normal course, performing our daily task with our accustomed zeal. Colonel Babtie, V.C., C.M.G., M.B., Inspector of Medical Services, inspected the Hospital on February 28, and we feel sure held very much the same opinion of it as we do ourselves—a charming place, an ideal situation for a hospital, but as a hospital not quite so satisfactory to the practised eye of the expert. The wards are beautiful, like the temples of the ancient Egyptian; the walls and marbled floors take us back to the era of the noble Rameses, and the priest-trodden walks of Philæ. Effective but primitive was their sanitary science then, effective but primitive must be our methods now

"Scarcely had we recovered from the disorganisation consequent on manœuvres, when the Duke of Connaught expressed a desire to inspect the Hospital; and very little of it did he miss, taking an interest in every part and in every disease, and

casting a discerning eye on any innovation, to wit, the appearance of a P. O. U. O. in the enteric ward.

"Manœuvres took place between March 1 and 8, in the desert for the most part, between the Fayoum Oasis and the pyramids of Sakkara—a large area for such small armies, and a dry one, too, in the heat of the day. On our backs rested the responsibility of a water supply both filtered and pure—not the same thing these two, when one's candles will crack, and one has the large-minded Tommy to deal with, and no man will prevent him washing his waterbottle out with drain water. Camel cacolets were used this year with much success, and helped along many a straggler exhausted and footsore. It was found that these camels could well keep pace with the column on the march, even though carrying two men—a small load for a good camel, and well below his limit of 400 lbs. The new Service pattern portable filters proved also a marked success, being the only ones entirely in the charge of the Royal Army Medical Corps, and, after the premature demise of the battalion filters, the sparkling water gushed forth from their vitals like unto that which Moses did strike forth from the rock; and thus again were watered the wanderers in the wilderness. We hear that the S.M.O. of the opposing force had a watercart, but we think it must have got lost in the sand.

"Our mess furniture has been distrained upon, the bailiffs are upon us, the Army Council has come to a decision. We are not entitled to mess furniture, and all that we possess must be returned to store forthwith. We have built a house upon the sand, and the storms have come. There is no room for eight more members in the Regimental Mess, we are not allowed to reside in the town, and we have but one room apiece as a quarter. Wondrous are the workings of the mighty! but there is a garden in which the wild thyme grows; and there shall we reside, with the daisies for a carpet, a grassy bank for couch; and from this blessed spot shall be sent in A.F. O. 1628 for Field Allowance. The Duke of Connaught was entreated to support our cause, and intends to do so, and all may still be well; but uneasy lies the head that wears a crown, and, after all, we do; nor do we find the prænomen of Royal ensures us peace and plenty in all things.'

NOTES FROM GIBRALTAR.—Major H. A. L. Howell, R.A.M.C., writing on March 12, says: "Lieutenant-Colonel H. W. Murray, our new Principal Medical Officer, and Lieutenant and Quartermaster E. P. Offord, arrived on February 18. On this same day Colonel Babtie, V.C., C.M.G. (who has been a week here on inspection duty) left for Egypt. On March 4 Major W. H. Horrocks (Medical Officer of Health and Senior Sanitary Officer) and Lieutenant and Quartermaster H. Woolley left Gibraltar on the 'Sicilia,' with many N.C.O.'s and men of the Corps, tour expired.

"Major Horrocks' departure is universally regretted. The *Gibraltar Chronicle* and the local Spanish papers contained references to the great loss Gibraltar has sustained in the departure of its Medical Officer of Health, and referred to his scientific abilities, and especially to his discovery of the presence of the microbe of Malta fever in the milk of infected goats. I am sorry I have mislaid the cuttings.

"The Gibraltar branch of the British Medical Association held its annual general meeting on March 3. The membership has fallen off, as far as the Royal Army Medical Corps is concerned. Major A. E. C. Keble, R.A.M.C., was elected Vice-President for 1908, and Major H. A. L. Howell, R.A.M.C., a member of Council. Major O. R. Robinson, R.A.M.C., is to be asked to represent the branch at the annual meeting in England this year.

"During the month Lieutenant C. M. Drew, R.A.M.C., delivered a lecture to the officers of the garrison on 'Inoculation against Typhoid Fever.' It was largely attended and was extremely interesting. Major Howell, R.A.M.C., has just completed a course of six lectures on 'Sanitation' to the officers of the garrison. The great interest shown in the subject by the large number who attended was very gratifying to the lecturer.

"The Royal Army Medical Corps gave a concert to their departing comrades at the Royal Naval Canteen on March 2. I enclose a report which appeared in the *Gibraltar Chronicle*:—

"'CONCERT AT THE ROYAL NAVAL CANTEEN.

"'The Royal Army Medical Corps gave a most successful entertainment on Monday evening at the Royal Naval Canteen. The house was crowded, the presence of the soldiers' wives being specially noticed, and a very good programme was put on, composed

entirely of N.C.O.'s and men of the Corps, which, when one considers the small strength upon which they have to draw, was a very creditable performance.

"'The entertainment was opened with "The Airship and the Swallow," by Private Thurgar, which was followed by "We parted on the Shore," by Private Cragg, who is coming on as a comedian and improving each time. The song was well received, as was also his "Weight lifting and classical posing" as "Professor Tuns," which produced much laughter. "I want to be a soldier" and "Don't cry, little girl," by Private Lawrence, "Love, could I only tell thee" and "You can't buy love," by Private Coles, "Will o' wisp" and "The white squall," by Lance-Corporal Lawrence, were also much appreciated. Serjeant Eallett sang "The Postman's holiday" in great form and was much applauded. Private Salter, who has sprung up recently as a descriptive vocalist, sang very finely "The mansion of aching hearts," and deserved the applause accorded him. Serjeant Lake sang "Anchored," and was well received. Serjeant Robinson sang "Bed, beautiful bed" and "Let me sing." The idea of the latter, judging by the shower of missiles, including boots, that were hurled at him, would appear to be "do what you like, but let me sing"; both songs were much applauded.

"'The farcical absurdity "The Colleen Bawn" was an absolute success, evoking roars of laughter, and the trio Serjeant Eallett, Privates Swann and Cragg, well deserved the applause they received.

"'It is scarcely necessary to write about the prowess of the inimitable Private Swann, who is too well known in the garrison to need comment here, but to sing four songs, take part in the sketch, and assist generally in the working of the entertainment throughout the evening, is in itself sufficient recommendation.—A.B.C.'

"The Royal Army Medical Corps here, though small in numbers, has managed to keep a football team in the field throughout the season. It got into the semi-final for the Governors' Cup, but was beaten by the Border Regiment by 3 goals to *nil*. The Corps made a better show than the figures represent. Houghton in goal was quite good, and Whygatt was the fastest and one of the best forwards on the field. We also have three or four men in the Staff and Department Team.

"We all regret to hear that Serjeant Reid, R.A.M.C., died during the voyage to England on the 'Sicilia.'"

NOTES FROM GLASGOW (April 27, 1908).—On April 22, 1908, the Senate of the University of Glasgow conferred the honorary degree of Doctor of Laws upon, among others, Colonel David Bruce, C.B., R.A.M.C. The official account says that the degree is given for "his discovery, at great personal risk, and by untiring labour, of the microbe which forms the inducing cause of Malta fever. To the researches to which that discovery led, the naval and military population of Malta owe their present immunity from a disease which has been the bane of the island for centuries. Similar work in Africa has resulted in extending our knowledge of the causes which produce the dreaded tsetse-fly disease of South Africa, and the epidemic sleeping sickness of Uganda. Work of this kind, requiring all the courage of the soldier, all the patience and acumen of the man of science, renders him amply entitled to any honour which a University can bestow."

NOTES FROM MILLBANK.—Lieutenant A. Irvine Fortescue writes: "H.M. the Queen, with her sister, the Empress Marie of Russia, and Princess Victoria, visited the Royal Military Hospital and the Royal Army Medical College at Millbank on Friday, March 20, 1908. The Queen, Empress, and Princess drove to the Hospital attended by General the Right Hon. Sir Dighton Probyn, V.C., Countess Heiden, the Marchioness of Lansdowne, and the Hon. Charlotte Knollys, and were received at the main entrance by (among others) Field-Marshal Earl Roberts, V.C., Sir Frederick Treves, Bart. (Serjeant-Surgeon to the King), and Sir Alfred Keogh, K.C.B., K.H.P. (Director-General of the Army Medical Service).

"The main object of the visit was informally to open the new nurses' home. Their Majesties, however, specially wished to inspect the kitchens and two or three of the wards. In the kitchens the Queen and the Empress displayed keen interest. Her Majesty thought the soldiers' bread particularly wholesome-looking and inviting. After tasting it the Queen selected a loaf, which she said should be placed on the royal table. The commanding officer promised to forward the loaf by a special messenger.

"The visitors went into two of the medical wards and into one surgical ward. To every patient whom she passed the Queen spoke a few kindly words. She asked one how he was progressing, and told another that she hoped he would soon be about again. She also enquired about the patients' respective ailments. Passing on to the Nurses' Home, their Majesties found all the sisters lined up in the hall. Every part of the

new premises was inspected by the royal visitors. The Queen, Empress, and Princess declared themselves much pleased with all they saw.

"On leaving the Hospital the royal ladies drove to the Royal Army Medical College, Millbank. The visitors inspected the Officers' mess and the laboratories. What seemed chiefly to interest their Majesties was the pathological laboratory. The royal visitors were shown, under the microscope, living organisms of the principal diseases which affect soldiers serving abroad. The Queen and Empress were deeply interested in the various germs. They both congratulated Sir Alfred Keogh on the advancement made by the Royal Army Medical Corps in checking the ravages of tropical diseases.

"Before taking their departure their Majesties declared that their visit had been both pleasant and instructive."

NOTES FROM PRETORIA.—Lieutenant-Colonel M. O'Halloran sends us the following list of arrivals, moves, &c., in the South African Command: "The undermentioned officers on arrival from England have been posted to stations as under: Lieutenant-Colonel J. Maher to Potchefstroom, as Officer Commanding Military Hospital; Lieutenant T. W. O. Sexton to Potchefstroom.

"The undermentioned officers proceeded to England on leave of absence on the dates specified: Lieutenant-Colonel W. Heffernan, February 29, 1908; Major J. G. Carter, March 7, 1908; Major J. R. McMunn, March 7, 1908; Captain J. T. McEntire, March 4, 1908; Captain E. H. M. Moore, March 8, 1908.

"The following changes amongst officers, Royal Army Medical Corps, have taken place in the South African Command: Lieutenant-Colonel M. O'Halloran, to Army Headquarters, Pretoria, as Staff Officer to Principal Medical Officer, South Africa, on being relieved as Officer Commanding Military Hospital, Standerton; Lieutenant-Colonel F. H. M. Burton, to Standerton from Bloemfontein, as Officer Commanding Military Hospital at that station; Lieutenant-Colonel S. Hickson to Wynberg, as Officer Commanding Military Hospital, from Harrismith; Lieutenant-Colonel T. E. Nodding to Harrismith, as Officer Commanding Military Hospital, from Cape Town; Major D. J. Collins to Wynberg, on arrival off leave; Major T. J. Leneham to Simons Town from Potchefstroom, as Medical Officer in charge of Troops.

"The undermentioned officers proceeded to England on the dates specified: Colonel J. C. Dorman, March 16, 1908, for promotion to Surgeon-General; Lieutenant-Colonel E. L. Maunsell, March 4, 1908, as the appointment of Administrative Medical Officer, Orange River Colony, has been amalgamated with that of the Transvaal District.

"The changes amongst the Queen Alexandra's Imperial Military Nursing Service are as follows: Sister E. C. Cheetham, from Potchefstroom to Robert's Heights, Pretoria, for duty; Sister A. M. Pagan, granted thirteen weeks leave to England, from March 4, 1908."

NOTES FROM SIMLA.—Lieutenant-Colonel H. B. Matthias, D.S.O., Secretary to Principal Medical Officer, H.M. Forces in India, writes under date March 19, 1908:—

"*Appointments.*—Following administrative medical officers of British Service are appointed and transferred to Divisions and Brigades mentioned as Principal Medical Officers: Colonel H. R. Whitehead transferred to 1st (Peshawar) Division; Colonel D. O'Sullivan appointed to Jubbulpore and Jhansi Brigades; Colonel O. E. P. Lloyd, V.C., transferred to Bareilly and Garhwal Brigades; Colonel F. B. Maclean appointed to Aden Brigade (temporarily). Following officers are appointed to command of station hospitals mentioned: Lieutenant-Colonel H. Cocks, Wellington; Major T. McCulloch, Lebong; Lieutenant-Colonel J. Meek is appointed Officiating Sanitary Officer, Army Headquarters.

"*Leave.*—Lieutenant-Colonel A. R. Aldridge, Sanitary Officer, Army Headquarters, has proceeded on leave from India from March 6, 1908.

"*Postings.*—Following officers who arrived from England on February 27th, 1908, are posted as follows: Lieutenant-Colonel H. J. R. Moberley to Burma Division, to command Station Hospital, Maymyo; Lieutenants H. Stewart and R. G. H. Tate to 3rd (Lahore) Division, to proceed first to Rawal Pindi to undergo one months instruction in sanitation. Lieutenant A. Dawson to 5th (Mhow) Division, first proceeding to Poona for one months instruction in sanitation. Following officers who arrived from England on March 11, 1908, are posted as follows: Major R. J. Copeland to 7th (Meerut) Division; Captain G. J. A. Ormsby to 8th (Lucknow) Division; Lieutenant A. D. O'Carroll to 3rd (Lahore) Division: to proceed first to Rawal Pindi to undergo one months instruction in sanitation; Lieutenant P. C. T. Davy to 5th (Mhow) Division, to proceed first to Poona to undergo one months instruction in sanitation.

" *Transfers.*—Major T. W. Gibbard has been transferred to Simla for special duty at Army Headquarters."

NOTES FROM STANDERTON, TRANSVAAL.—Serjeant-Major Rapson writes: "Some considerable period has elapsed since the editorial peace of the Journal was last disturbed by news of the happenings at this station. Consequently, a brief *résumé* of the events of the last twelve months or so may prove of interest, if only to remind some of our friends and comrades, who have at some time or other served here, that Standerton still figures on the map, and also still boasts a Military Hospital and a Royal Army Medical Corps Detachment.

"In May, 1907, our Commanding Officer, Lieutenant-Colonel F. H. M. Burton, left the station on long leave to England, and Captain L. Addams-Williams assumed control. This officer, well known as one of the best and most enthusiastic athletes in the Corps, had, while Company Officer, done wonders to initiate and encourage all forms of sport, and during his period of command, interest in this direction was, if anything, increased. It must be remembered that during the last year the strength of the detachment has fluctuated considerably, being at times as low as twelve, and at its highest never rising above thirty. In spite of this, Captain Addams-Williams ran a very successful 1906-7 cricket team, and in 1907 organised a hockey team which proved itself the champion team of the garrison, beating all combinations, civilian and military alike. Indeed, the performances of this team provided quite a sensation in the world of sport at Standerton.

"In October, 1907, Captain L. Addams-Williams proceeded to England on leave, thus depriving us of an extremely popular Commanding Officer and sportsman. Lieutenant-Colonel M. O'Halloran, arriving from England, took over the command of the station.

"A very fair cricket team had been worked up for the 1907-8 season under the leadership of Captain P. J. Hanafin, our Company Officer, but owing to repeated losses of talent due to men proceeding to England and other stations, it sank to a very low level of ability. Lieutenant-Colonel O'Halloran on his arrival took the team in hand, reorganised the finances and practice arrangements, and by showing an extremely active interest in his position as President of the Sports Club, soon put a very different complexion on the state of affairs. One of the innovations introduced by the Commanding Officer, and which found much favour, greatly conducing as it did to the pleasure and success of the matches, was the provision of suitable refreshments for the Company and civilian teams who visited us. As a result of the various improvements, and also the opportune arrival of a batch of new players, we were enabled to finish the season in a manner which, had it obtained from the first, would have placed us among the most successful teams in the garrison.

"At the end of December, 1907, Major H. P. Johnson arrived from England for duty, and, on the departure of Captain P. J. Hanafin for Pretoria in January, 1908, took over the duties of Company Officer.

"At the present date (March, 1908) we are busily engaged in forming hockey and football teams to do battle during the forthcoming winter. Our prospects appear to be very good, although it is doubtful whether our hockey will be of quite such good class as it was last year. In football we hope to considerably improve on the lamentable weakness of 1907. Thanks to the efforts of Lieutenant-Colonel O'Halloran, the Sports Ground is now in magnificent condition for both the winter games.

"The fact that we have so few opportunities for social amenities at this station, accounts for the paucity of the notes under this heading. Of course, we had a Christmas of the very best sort, no trouble or expense being spared to render it true to old time traditions. The dinner was a triumph of cooking, serving. and table decoration, and the subsequent concert and dance, held in the tastefully decorated mess-room, with its gem of a miniature stage, was thoroughly enjoyed by officers and men.

" Early in January, 1908, the N.C.O.s' Mess invited the Warrant Officers and Senior N.C.O.'s of the garrison to a New Year's Dinner and Concert, in return for many hospitalities on their part during the past year. This gathering was a huge success.

"Another event, the success of which proves how easy it should be to establish a little social life amongst us, was the farewell concert organised, by permission of the Commanding Officer, in honour of Privates Claxton and Lloyd, who were leaving for England at the expiration of their tour in South Africa. Both these men were members of the above-mentioned invincible hockey team, and Private Claxton was in addition an all-round athlete, whose abilities on the Sports' Field will be appreciated wherever he goes. An excellent programme was produced at the Smoking Concert

which signalised their departure, and all the attendant arrangements necessary to the success of such events were of the best.

"Since the departure of the Loyal North Lancashire Regiment in October, 1907, the station has been without a military band. Consequently we were delighted when, during 'Polo Week,' the Royal Fusiliers' Band from Pretoria was induced to visit the Military Hospital. After we had listened to a well-selected programme, the musicians were entertained by the detachment in a manner which they seemed greatly to appreciate. The officers and staff gave an 'At Home' on the occasion, and quite a number of civilian friends put in an appearance.

"At the beginning of the present month (March 1908), Lieutenant-Colonel M. O'Halloran left us to take over the duties of Staff Officer to the Principal Medical Officer, South Africa, at Pretoria; and Lieutenant Colonel F. H. M. Burton arrived from Bloemfontein to re-assume charge of his former command."

NOTES FROM WYNBERG.—Serjeant-Major C. W. Kinsella writes: "By this week's intermediate Union-Castle steamer 'Galician,' we have to regret the departure of Colonel J. C. Dorman, C.M.G., who has occupied the posts of Administrative Medical Officer and Officer Commanding, Royal Army Medical Corps, Cape Colony, for the past four years. In his farewell order, Colonel Dorman expresses thanks for the good service and support he received from all ranks during his tenure of office, and in expressing his regret at severing his connection with the Company, hopes that he may meet some of its members under his command at Home, sentiments which are heartily reciprocated by all those who have served under him.

"Mrs. and the Misses Dorman have also much endeared themselves to the married families by their kindnesses, and their absence from our Christmas and other gaieties will be much felt. One and all unite in wishing the Colonel and his family the best of luck in his new and exalted sphere. At the time of writing Lieutenant-Colonel Peterkin is stated to be our new Administrative Medical Officer, and pending his arrival from Mauritius the duties devolve on Lieutenant-Colonel Hickson, O.C. 22nd Company.

"Major McNaught, Specialist Sanitary Officer, has passed the examination for the rank of Lieutenant-Colonel. Serjeant-Major Kinsella passed in Military History (d, iv.), at the November, 1907, examination, and now only requires subhead d, i. to have completed subject "d."

TERRITORIAL ARMY.

The undermentioned officers have been appointed Staff Officers to Administrative Medical Officers of Divisions of the Territorial Force:—

Colonel J. Magill, C.B., A.M.S., retired pay, 2nd London Division; Lieutenant-Colonel J. D. T. Reckitt, R.A.M.C., retired pay, 1st London Division; Major E. C. Freeman, R.A.M.C., retired pay, East Anglian Division; Lieutenant-Colonel G. Scott, R.A.M.C., retired pay, Highland Division; Lieutenant-Colonel E. O. Wight, R.A.M.C., retired pay, Home Counties Division.

Applications for similar appointments, which are open to retired officers, should be made to the Director General, Army Medical Service.

ROYAL ARMY MEDICAL CORPS (VOLUNTEERS).

London District, London Companies.—The following announcement is substituted for that which appeared in the *London Gazette* of September 3, 1907: George Langrigg Leathes Lawson (late Surgeon-Captain, 6th Regiment, Imperial Bushmen, New South Wales) to be Lieutenant, dated June 1, 1907.

Liverpool Bearer Company.—Captain Samuel H. House, M.B., resigns his commission, dated March 31, 1908.

Welsh Bearer Company.—Major Charles Downing (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer, Welsh Volunteer Infantry Brigade) to be Lieutenant-Colonel, remaining Supernumerary, dated March 2, 1908.

AUXILIARY FORCES.

Honourable Artillery Company of London.—Surgeon-Lieutenant John F. Taylor to be Surgeon-Captain, dated March 10, 1908.

IMPERIAL YEOMANRY.

Royal East Kent (The Duke of Connaught's Own.)—Campbell Tilbury Fox to be Surgeon-Lieutenant, dated February 26, 1908.

Northamptonshire.—Surgeon-Lieutenant Edward M. Knott resigns his commission, dated February 24, 1908.

Lincolnshire.—Surgeon-Major Thomas H. Openshaw, C.M.G., M.B., F.R.C.S., to be Surgeon-Lieutenant-Colonel, dated February 22, 1908.

Essex.—Surgeon-Lieutenant Joseph J. Macgregor, M.D., is removed from the Imperial Yeomanry for absence without leave, dated March 13, 1908.

Glamorganshire.—Surgeon-Lieutenant Colin C. McCall resigns his commission, dated March 1, 1908.

ARMY MEDICAL RESERVE OF OFFICERS.

Surgeon-Captain William Richardson, M.D., to be Surgeon-Major, dated March 3, 1908.

Surgeon-Captain Edgar W. Livesey to be Surgeon-Major, dated March 14, 1908.

The notification in the Gazette of March 3, 1908, that Surgeon-Captain Samuel M. Sloan, M.D., ceased to belong to the Army Medical Reserve of Officers, is cancelled.

OTHER VOLUNTEER CORPS.

24th Middlesex Volunteer Rifle Corps.—Surgeon-Captain C. Graham Grant to be Surgeon-Major, dated January 31, 1908.

The Highland (R.G.A).—Surgeon-Major J. M. Moir, M.D., to be Surgeon-Lieutenant Colonel, dated February 10, 1908.

2nd Lancashire.—Surgeon-Captain Thomas Stevenson, M.B., to be Surgeon-Major, dated March 3, 1908.

7th (Isle of Man) Volunteer Battalion The King's (Liverpool Regiment).—Surgeon-Captain William Richardson, M.D., to be Surgeon-Major, dated February 13, 1908.

2nd (Prince of Wales's) Volunteer Battalion The Devonshire Regiment.—Surgeon-Captain Ernest P. A. Mariette, M.B., to be Surgeon-Major, dated February 18, 1908.

1st Cinque Ports Volunteer Rifle Corps.—Alfred Alexander to be Surgeon-Lieutenant, dated February 24, 1908.

1st Volunteer Battalion The Durham Light Infantry.—Douglas Vercoe Haig, M.D., to be Surgeon-Lieutenant, dated January 30, 1908. David Leonard Fisher, M.B., to be Surgeon-Lieutenant, dated January 31, 1908. George Greig Farquhar, M.B., to be Surgeon-Lieutenant, dated February 1, 1908.

2nd Hampshire.—Percy James Sandys Bird, late Surgeon-Captain, 1st West Riding of Yorkshire Royal Garrison Artillery (Volunteers), to be Second Lieutenant, dated February 1, 1908.

1st Northumberland.—Surgeon-Captain (Honorary Captain in the Army) John Wreford to be Surgeon-Major, dated March 6, 1908.

3rd Volunteer Battalion The Northumberland Fusiliers. — Surgeon-Lieutenant Herbert M. Jamieson, M.B., resigns his commission, dated February 29, 1908.

5th (Irish) Volunteer Battalion The King's (Liverpool Regiment).—Surgeon-Captain John J. O'Hagan, M.B., F.R.C.S.(I.), to be Surgeon-Major, dated February 25, 1908.

1st Volunteer Battalion The Hampshire Regiment.—Surgeon-Lieutenant Herbert J. Godwin to be Surgeon-Captain, remaining Supernumerary, dated February 22, 1908.

2nd Volunteer Battalion The Hampshire Regiment.—Surgeon-Lieutenant Robert E. Lauder to be Surgeon-Captain, dated February 7, 1908.

3rd Volunteer Battalion The Essex Regiment..—Surgeon-Captain Francis J. Warwick, M.B., to be Surgeon-Major, dated February 26, 1908.

3rd Volunteer Battalion The Queen's Own (Royal West Kent Regiment).—Surgeon-Captain Lewis T. F. Bryett, M.D., to be Surgeon-Major, dated January 21, 1908.

5th (Irish) Volunteer Battalion The King's (Liverpool Regiment). — Surgeon-Lieutenant John M. Ahern to be Surgeon-Captain, dated March 7, 1908.

1st Volunteer Battalion The Prince of Wales's Own (West Yorkshire Regiment).—Surgeon-Captain Alexander R. Stoddart, M.B., to be Surgeon-Major, dated January 31, 1908.

2nd (Berwickshire) Volunteer Battalion The King's Own Scottish Borderers.—Surgeon-Lieutenant David Skinner is retired, under the conditions of paragraph 103 of the Volunteer Regulations, dated March 21, 1908.

Galloway Volunteer Rifle Corps.—Surgeon-Captain Robert T. Bell Lorraine, M.B.,

resigns his commission, with permission to retain his rank and to wear the prescribed uniform, dated March 6, 1908.

1*st Cinque Ports Volunteer Rifle Corps.*—Peter Millar Waugh, M.B., to be Surgeon-Lieutenant, dated March 9, 1908.

1*st London Volunteer Rifle Corps.*—Surgeon-Captain Arthur D. Ducat, M.B., to be Surgeon-Major, dated March 31, 1908.

4*th (Donside Highland) Volunteer Battalion The Gordon Highlanders.*—Surgeon-Major Alexander Nicol, M.D., to be Surgeon-Lieutenant-Colonel, dated March 10, 1908.

1*st Dumbartonshire Volunteer Rifle Corps.*—Surgeon-Major John R. F. Cullen, M.B., to be Surgeon-Lieutenant-Colonel, dated March 4, 1908.

Surgeon-Lieutenant-Colonel John R. F. Cullen, M.B., resigns his commission, with permission to retain his rank and to wear the prescribed uniform, dated March 5, 1908.

1*st Banff.*—Surgeon-Lieutenant John H. Stephen to be Surgeon-Captain, dated March 13, 1908.

6*th Lancashire.*—Surgeon-Captain Francis W. Bailey resigns his commission, dated March 9, 1908.

Francis William Bailey (late Surgeon-Captain) to be Captain, dated March 13, 1908.

The Queen's Rifle Volunteer Brigade, The Royal Scots (Lothian Regiment).—Surgeon-Major John Pirie, M.B., resigns his commission, dated March 16, 1908.

2*nd Volunteer Battalion The Northumberland Fusiliers.* — Surgeon-Lieutenant-Colonel and Honorary Surgeon-Colonel Adam Wilson (Brigade-Surgeon-Lieutenant-Colonel, Senior Medical Officer Tyne Volunteer Infantry Brigade) resigns his commission, with permission to retain his rank and to wear the prescribed uniform, dated March 4, 1908.

24*th Middlesex Volunteer Rifle Corps.*—Surgeon-Major Charles Graham Grant to be Surgeon-Lieutenant-Colonel, dated March 16, 1908.

ROYAL ARMY MEDICAL COLLEGE.

Examination of Captains for Promotion to Major.

Hygiene (for Class). (Written.)—Monday, March 30, 1908. From 10 a.m. to 1 p.m.

[N.B.—*Only* FOUR *questions to be answered, of which Question* 5 *must be one.*]

(1) What are your views as to the sufficiency or otherwise of the dietary provided for the British soldier at home stations at the present time? State the usual articles of which this consists, and critically discuss the amount of the nitrogenous food, in the light of recent researches.

(2) What are the sanitary points to which you would direct your attention when on the march—

(*a*) On leaving camp in the early morning? (*b*) While on the road? (*c*) Immediately on arrival at camp in the evening?

(3) Contrast any methods of water purification in the field that you may be acquainted with—

(*a*) As to facility of transport; (*b*) ease in working; (*c*) rapidity of delivery; (*d*) safety afforded.

(4) What are the important factors concerned in the prevalence of malarial fever? State briefly the measures you would personally recommend for its prevention.

(5) Describe the procedure you would adopt, on receipt of a sample of water, to determine its fitness for drinking or otherwise, from information derived from its bacterial contents.

Hygiene (for Class). (Practical.)—Saturday, March 28, 1908. From 10 a.m. to 1 p.m.

(1) Examine the sample of water before you as follows :—

(*a*) Qualitatively, for metals; (*b*) quantitatively, for : (i.) Hardness, removable and fixed ; (ii.) nitrates.

The standard solutions are as follows :—

Soap solution: 1 cc. = 1 mgm. Ca CO_3.
Potassium nitrate solution : 1 cc. = 0·01 mgm. N.
Express your results in parts per 100,000 and in grains per gallon.

(2) Examine the sample of beer before you for—
(a) Alcohol; (b) acidity; (c) extract.
Give an opinion as to the quality of the beer.

Pathology (for Class).—Written Examination. Monday, March 30, 1908. From 2.30 p.m. to 5.30 p.m.

(1) What changes have been found to occur during the course of an attack of enteric fever in respect to the coagulability of the blood? By what method would you estimate these changes?

(2) Give an account of the tests which you would apply in carrying out a bacteriological diagnosis of diphtheria. Discuss the limitations of these tests in the event of a report being required within twenty-four hours.

(3) What is the distribution of the *Bacillus pestis* in the body in a case of bubonic plague? Describe shortly the part which appears to be played by the rat flea in the dissemination of this disease.

(4) Describe the embryonic form of the *Filaria bancrofti*. What is supposed to be the method of infection, and with what pathological conditions is this parasite associated?

Pathology (for Class).—Practical Examination. Tuesday, March 31, 1908. From 10 a.m. to 1 p.m.

(1) Make a careful examination of the plate culture provided, and describe the morphological characters of the germs comprising the various colonies. Leave a stained specimen of each of the varieties which you have found beside your microscope.

(2) Stain the unfixed blood film so as to demonstrate the presence of malarial parasites. Describe shortly in your paper the forms which you have encountered, and your opinion as to the variety of malaria. Leave the film beside your microscope.

(3) Stain the bacterial film marked "A" by Ziehl-Neelsen's method, and describe what you find. Leave your specimen in focus under your oil-immersion lens.

(4) Oral examination on specimens displayed under the microscope.

ROYAL ARMY MEDICAL CORPS ANNUAL DINNER.

The Annual Dinner of the Corps will take place on Monday, June 15, at the "Empire Hall," Trocadero Restaurant, Piccadilly Circus, W., at 8 o'clock precisely, the Director-General in the chair. Officers intending to dine are requested to inform the Hon. Secretary as soon as possible, in order that the probable number attending may be known and that tickets may be sent. A plan of the tables will be prepared, and officers intending to dine may inspect the same at the Trocadero Restaurant any time upon the day of the Dinner and arrange their seats.

66, Scarsdale Villas,
Kensington, W.

H. C. Thurston, *Major, R.A.M.C.,*
Hon. Sec. Sub-Committee, R.A.M.C.
Dinner Fund.

REGISTER FOR INDIAN SERVANTS.

Few officers on going to India have not experienced the difficulty of getting good servants. The discomforts on arrival and of a long journey up country, unprovided with a bearer, or, what is worse, provided with a hastily selected man, taken haphazard from the crowd of indifferent or bad characters who congregate in Bombay, have fallen to the lot of most of us, whilst the period of trial and vexation until a proper staff of servants is secured is familiar to us all.

In our Corps, with regular annual reliefs, it should not be difficult to arrange for an interchange. Officers leaving India would then be able to provide places for the good and tried retainers they are relinquishing, and new arrivals would, by taking on these men, be spared many of the worries and troubles which now befall them. Further, good servants would not be lost to the Corps, and the prospects of continuous employment could not fail to have attraction for the better class of men.

With these ends in view, officers due home from India are requested to communicate to the Journal particulars of servants whom they can recommend, so that officers

going out in relief may have an opportunity of securing these men. The particulars required are:—

(1) Class of servant.
(2) Whether for bachelor or married officer.
(3) District or station to which he belongs.
(4) Any special recommendations.

NOTE.—The date the officer leaves India should also be stated, and when and where the servant will be available.

THE RETIREMENT OF MR. GILLHAM.

The following additional subscriptions have been received:—

	£	s.	d.
Lieutenant-Colonel E. M. Wilson, C.B., C.M.G., D.S.O. ...	0	10	0
Captain G. H. Goddard ...	0	10	0
Captain M. M. Lowsley ...	1	1	0
Surgeon-Major P. H. Whiston ...	0	10	6
Major W. T. Mould ...	0	10	0
Major L. P. More ...	1	1	0
Major C. G. Spencer ...	1	0	0
Lieutenant-Colonel J. V. Salvage ...	0	10	6

Subscriptions to the "Gillham Fund" may be sent to Captain C. J. Wanhill, R.A.M.C., Royal Army Medical College, Millbank, London, S.W., and will be acknowledged in the Corps News.

ARMY MEDICAL OFFICERS' BENEVOLENT SOCIETY.

THE Annual General Meeting of subscribers to the above Society will be held in the theatre of the Royal Army Medical College, Millbank, at 2.30 p.m., on Monday, June 15, 1908. The Director-General will preside. Those officers who wish for information on any special points are requested to communicate with the Secretary, Lieutenant-Colonel F. W. H. Davie Harris, St. George's Barracks, W.C., so that information may be furnished in response to any question asked.

F. W. H. DAVIE HARRIS, *Lieutenant-Colonel,*
Secretary.

ROYAL ARMY MEDICAL CORPS FUND.

NOTICE OF THE SIXTH ANNUAL GENERAL MEETING.

THE sixth Annual General Meeting of subscribers to this Fund will be held in the theatre of the Royal Army Medical College, Millbank, at 3.30 p.m., on Monday, June 15, 1908. The Director-General will preside.

Agenda.

(i.) To receive the report of the Committee appointed at the last General Meeting as to whether the Royal Army Medical Corps Fund subscription should include the Corps Journal.

(ii.) To consider a recommendation made by the Committee that "A grant be made annually to the General Relief Fund by the Annual General Meeting, such grant to be determined by the state of the finances at the time."

(iii.) To consider a resolution proposed by Colonel James, that "As the Royal Army Medical Corps Mess in London is a central institution and will continually entertain distinguished people, as well as, occasionally, bodies of scientific men whose knowledge is of great importance to the Corps at large, it is urged that the expenses which will be and are incurred by such entertainments should not fall entirely upon the officers for

the time being living in the London Mess, but that they should be assessed against the Corps, and, in default of a subscription to the Mess from every member of the Corps, that the Corps Fund should contribute to such entertainments by an annual grant in aid of the Mess."

(iv.) To consider a resolution proposed by Colonel Sloggett, C.M.G., that "The Committee of the Royal Army Medical Corps Fund shall consist of thirteen members, nine on full pay and four on retired pay; of the former the Director-General and Deputy Director-General shall be respectively Chairman and Vice-Chairman of the Committee; of the four retired pay officers, one shall retire annually, and shall not be eligible for re-election for a period of one year."

It is hoped that officers will freely express their views on any point connected with the Fund. Those officers who may wish for information on any special point are requested to communicate with the Secretary at St. George's Barracks, W.C., so that information may be furnished in response to any question asked.

F. W. H. Davie Harris, *Lieutenant-Colonel,*
Secretary.

Note that the Annual Meetings of the above Society and Fund will be held at the Royal Army Medical College at Millbank this year, instead of at the Royal United Service Institution.

ROYAL ARMY MEDICAL CORPS FUND.

The thirty-third Committee Meeting was held at the War Office at 3.30 p.m. on Monday, April 13, 1908.

Present.

Surgeon-General Sir Alfred Keogh, K.C.B., K.H.P., Director-General, in the Chair.
Surgeon-General Sir Thomas Gallwey, K.C.M.G.
Surgeon-General Sir Charles Cuffe, K.C.B.
Surgeon-General W. Fawcett, C.B.
Colonel A. T. Sloggett, C.M.G.
Colonel D. Wardrop.
Colonel Sir James Clark, C.B., Bart.
Lieutenant-Colonel E. M. Wilson, C.B., C.M.G., D.S.O.
Major H. C. Thurston, C.M.G.
Major C. G. Spencer.
Captain H. R. Bateman.

Colonel D. Wardrop took his seat on the Committee as Commandant Royal Army Medical College, *vice* Colonel H. E. R. James.

(1) The Minutes of the last Meeting were read and confirmed.

(2) *General Relief.*—It was noted that the following sums were received from Companies for the General Relief Fund during the quarter ending March 31, 1908.

		£	s.	d.
No. 7 Company,	Devonport	3	0	0
,, 9 ,,	Colchester	2	10	0
,, 10 ,,	Chatham	3	0	0
,, 12 ,,	Woolwich	5	0	0
,, 18 ,,	London	6	10	0
,, 19 ,,	Chester	4	6	0
,, 24 ,,	Bloemfontein	20	0	0
Detachment,	Middleburg, Transvaal ..	6	1	0
,,	Tipperary	1	1	0
,,	Harrismith	20	0	0

(3) The grants made from the General Relief Fund for the quarter ending March 31 were confirmed, and a list of the recipients are attached to these Minutes.

On the proposal of Colonel Sir James Clark it was resolved that the following women should receive no further grants from the Fund:—

Mrs. S., Mrs. M., Mrs. G., Mrs. H., Mrs. W., Mrs. L. and Mrs. R.

RECIPIENTS FROM THE GENERAL RELIEF FUND FOR THE QUARTER ENDING MARCH 31, 1908.

Name	Age	District	Grant	Total	Remarks
Mrs. I.	63	Dublin ..	£2	£6	Decrepit, unable to work.
Mrs. S.	70	,, ..	£2	£84	Decrepit and blind.
Mrs. H... ..	61	,, ..	£1 10s.	£43 10s.	Old. Child to support.
Mrs. B... ..	40	,, ..	£1 10s.	£13 10s.	Two children to support.
Mrs. S.	39	London ..	£2	£110	Two children to support.
Mrs. S.	65	,, ..	£2	£34 10s.	Too old to work much.
Mrs. K... ..	69	,, ..	£2	£74	Suffers from rheumatism.
Mrs. W. ..	32	,, ..	£1 16s.	£9 2s.	Has to maintain young child.
Mrs. B... ..	70	,, .	£2	£22 10s.	Too old to work.
Mr. N.	63	,, ..	£2	£48	Almost blind.
Mrs. G... ..	41	,, ..	£2	£40	Children to support.
Mrs. C.	..	,, ..	£1 16s.	£34	Bad health—past work.
Mr. G.	37	Aldershot..	£2	£10	Almost blind. Wife an invalid.
Mrs. G... ..	51	Dublin ..	30s.	£34	Has a child to support.
Mrs. R... ..	47	,, ..	30s.	£106 10s.	Invalid—unfit for hard work.
Mrs. D... ..	49	,, ..	£2	£2	For funeral of son.
Mrs. M... ..	42	Dover ..	30s.	£45 10s.	Bad health; a child a cripple.
Mr. J. C. ..	40	London ..	10s.	10s.	Destitute, out of work.
Mr. D. L. ..	34	,, ..	£1	£4 10s.	Wife recently confined.
Mr. L.	33	Jersey ..	£2	£2	Suffers from tubercle.
Mr. C. B. ..	39	London ..	11s. 6d.	£2 11s. 6d.	Destitute.
Mrs. W. ..	35	,, ..	£2	£2	Two children to support.
Mr. A. J. ..	38	,, ..	£1	£1	Destitute.
Mr. B.	..	,, ..	12s.	12s.	To replace lost medal.
Mrs. L.	40	Cork ..	£2	£22	Two children to support.
Mr. T. S. ..	38	Portsmouth	£2	£2	Lost use of limbs.
Mr. F. W. ..	47	Netley ..	£2	£2	Paralysed.
Mrs. S.	29	,, ..	£2	£2	Has a baby to nurse.
Mr. E. H. ..	43	London ..	10s. %	10s.	Destitute.
Mr. W. M. ..	44	,, ..	10s. %	10s.	Destitute.
Mr. C.	27	Chester ..	£1	£1	Destitute.

Total grants, £48 15s.

(4) *Band.*—A supplementary grant of £50 to the Band for last quarter was sanctioned. On the proposal of Surgeon-General Sir Thomas Gallwey, seconded by Colonel Sir James Clark, it was resolved that an extra sum not exceeding £130 be given to the Band Sub-committee to cover the expenses of erecting a band practice-room at Aldershot.

The band accounts were considered and passed and are appended to these Minutes.

A grant of £100 was voted for the current quarter's expenses.

REPORT OF THE DINNER SUB-COMMITTEE FOR 1908.

The Sub-Committee report:—

(1) That Colonel D. Wardrop, Commandant, R.A.M.C. College, succeeds Colonel H. E. R. James, who has vacated that appointment.

(2) That Major C. B. Martin has been nominated by the Principal Medical Officer, Netley, to succeed Colonel D. Wardrop on this Committee, and Major E. W. W. Cochrane, by the Principal Medical Officer, Aldershot, to succeed Major E. B. Steel.

(3) That they consider the Dinner for 1907, held at the Trocadero, was satisfactory, and have arranged for the annual gathering this year to be held in the same rooms on June 15.

(4) That the number of members who continued during the past year to subscribe to the Old Dinner Fund was 45, as compared with 53 in 1906.

(5) That 203 past and present officers of the Corps dined on June 17 last. This is the largest gathering on record.

(6) Recommend that the charge for tickets to subscribers be not more than 7s. 6d.,

ROYAL ARMY MEDICAL CORPS BAND FUND.

BALANCE SHEET FOR QUARTER ENDING MARCH 31, 1908.

RECEIPTS.

Date. 1908.		£	s.	d.
Jan. 1.	Balance credit	4	13	0
,, 3.	Three Officers' separate Subscriptions to Band Fund	0	15	0
,, 16.	Refund from College of Engagement Fees and Expenses, Nov. 27 and Dec. 18, 1907	10	4	10
,, 20.	Refund from Netley for December 5, 1907..	6	19	0
,, 21.	Quarterly grant from Corps Fund	97	0	0
,, 22.	Subscriptions, Officers' Mess, Aldershot, Dec.	5	10	0
Feb. 14.	,, ,, ,, ,, Jan.	5	7	6
March 5.	Supplementary Grant from Corps Fund ..	50	0	0
,, 14.	Subscriptions, Officers' Mess, Aldershot, Feb.	5	2	6
	Total	£185	11	10

EXPENDITURE.

Date. 1908.		£	s.	d.
Jan. 23.	Mr. T. W. Bennett, Gratuity on Retirement	30	0	0
,, ,,	,, ,, Salary, January 1 to 17	5	9	9
,, 28.	Advertisements	0	11	0
,, 30.	Mr. G. P. Robertson, Bandmaster, Salary from January 15	5	0	0
,, ,,	Band Pay, January	12	10	7
,, ,,	Mr. Robertson, Travelling Expenses on joining	2	14	6
Feb. 28.	Bandmaster's Salary, February	10	0	0
,, ,,	Band Pay	12	0	4
,, ,,	Twelve Candle Brackets	0	6	0
,, ,,	Bandmaster—Fares to London, to tailor (thrice), 9s. 6d.; carriage on uniform, 2s. 5d.; gloves, 10s...	1	1	11
Mar. 11.	Hawkes & Co., Bandmaster's Uniform ..	46	5	6
,, 28.	Bandmaster's Salary, March	10	0	0
,, ,,	Band Pay	12	4	1
,, 30.	W. Huntley, Boots for Bandmaster.. ..	1	19	6
,, ,,	Boosey and Co., B♭ Tenor Saxophone and Music	20	4	10
,, ,,	Hawkes and Son, Music and Repairs ..	8	14	6
,, ,,	Gale and Polden, Cards and Printing ..	1	0	0
,, 31.	Sergeant Holmes, altering Tunics	1	8	0
,, ,,	Credit Balance	4	1	4
	Total	£185	11	10

Aldershot,
April 1, 1908.

(*Signed*) E. T. F. BIRRELL, *Major,*
Band President, R.A.M.C.

and to non-subscribers £1 12s. 6d; a grant being voted from the Royal Army Medical Corps Fund to defray the amount.

March 13, 1908. (Signed) H. C. Thurston, *Hon. Sec.*

(5) The Report of the Dinner Sub-Committee was considered and passed, and is attached to these minutes.

(6) The draft of the Trustee Deed for the General Relief Fund was then considered, and the following resolution was proposed by Colonel Sir James Clark, seconded by Surgeon-General Sir Thomas Gallwey, and passed :—

"That Vesey George Mackenzie Holt, of No. 3, Whitehall Place, London, Banker and Army Agent; Sir Alfred Keogh, K.C.B., Surgeon-General in His Majesty's Army, and Director General, Army Medical Service; and Douglas Wardrop, of the Royal Army Medical College, Millbank, London, a Colonel in the Army, be and are hereby nominated trustees of a sum of £1,100, and of any additions that may from time to time be made thereto, and are requested to execute a settlement thereof in the form of the draft of such settlement produced at this meeting, and to hold the said sum and any additions thereto and the investment for the time being, representing the same upon the trusts herein contained, and they are also hereby authorised and requested to invest in their names the said sum in some investments or investment, authorised by such settlement. And it is further resolved that, upon the execution by the above-named Trustees, of the above-mentioned settlement, that Messrs. Holt and Co. be instructed to hold the said sum of £1,100 at the direction of such Trustees for investment.

(7) The Committee inspected the Tulloch Memorial Medal, and directed that a letter of thanks be sent to Miss Steele for designing the medal. It was noted that after paying Messrs. Spinks and Co.'s bill for £31 9s. 6d., the balance £68 10s. 6d of the £100 voted for the Tulloch Memorial Medal has been handed over to the Prize Committee for investment, in accordance with minute 2 of the last meeting.

(8) The question of getting the child Ivy Laws into a school was considered. As there is a probability of getting the child admitted free into the Drummond Institution on her attaining the age of seven, it was resolved that no application should at present be made to the Royal Soldiers' Daughters' Home to take her on payment.

(9) The Chairman brought forward the question of memorialising the late Surgeon-Major George Williamson, A.M.S., whose collection of skulls is now in the College Museum. It was resolved to place a brass plate bearing an inscription with his name over each of the cases containing his collection, and that in future the collection shall be known as "The Williamson Collection."

(10) The question of making a grant to the South African Graves Fund was postponed for future discussion.

(11) Colonel D. Wardrop was appointed an auditor, *vice* Colonel H. E. R. James.

F. W. H. Davie Harris, *Lieutenant-Colonel*,
April 13, 1908. *Secretary*.

ARMY MEDICAL OFFICERS' BENEVOLENT SOCIETY.

Proceedings of a Committee Meeting held at the War Office on Monday, April 13, 1908.

Present.

Surgeon-General Sir Alfred Keogh, K.C.B., Director-General, in the chair.
Surgeon-General Sir Charles Cuffe, K.C.B.
Colonel A. T. Sloggett, C.M.G.
Lieutenant-Colonel W. G. Macpherson, C.M.G.
Colonel H. E. R. James.
Lieutenant-Colonel A. M. Davies.

(1) The Minutes of the last meeting were read and confirmed.

(2) The Committee carefully considered twenty-four applications for grants, and recommended twenty applicants, representing twenty-nine orphans, for grants, to be considered by the Annual General Meeting, the list of which will be published after the General Meeting.

(3) It was proposed by the Chairman and seconded by Colonel A. T. Sloggett, that

a Sub-Committee consisting of Lieutenant-Colonel A. M. Davies, Lieutenant-Colonel W. G. Macpherson and the Secretary be appointed to examine, and if necessary revise, the form of application now sent to applicants.

(4) It was resolved that strict enquiries be made before the Annual Meeting, of the Principal Medical Officers of the districts in which they reside, of the financial condition of the applicants now recommended for grants.

(5) Letters of regret for non-attendance were received from Colonel Lane Notter and Captain Sewell.

F. W. H. Davie Harris, *Lieutenant-Colonel,*
Secretary.

April 13, 1908.

BIRTHS.

CARR.—At Nasirabad, on April 1, the wife of Lieutenant-Colonel H. Carr, R.A.M.C., of a daughter.

LEWIS.—On March 3, at the Cantonments, Standerton, Transvaal, the wife of Captain Stanley E. Lewis, R.A.M.C., of a daughter.

MARRIAGE.

HALE—SCOTT.—At St. Thomas's Church, Hyderabad, Sind, on March 25, by the Rev. H. Naish, Lieutenant-Colonel G. E. Hale, D.S.O., R.A.M.C., eldest son of the late G. W. Hale, Esq., of Glenwood, Paignton, to Lucy Fead Scott, youngest daughter of the late Captain W. Scott, R.A.

EXCHANGE.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

Deaths
See page 106-7

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, &c. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only, they should by preference be type-written, but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," Royal Army Medical College, Millbank, London, S.W.

Communications have been received from Colonel F. J. Lambkin, Lieutenant-Colonels R. J. S. Simpson, C.M.G., C. Birt, A. M. Davies, C. H. Melville, H. Carr, J. E. Nicholson, N. Manders. Majors F. E. Gunter, E. B. Steel, W. H. Horrocks, R. J. Blackham, C. B. Lawson, F. J. Wade-Brown, B. W. Longhurst, G. S. Crawford. Captains S. de C. O'Grady, J. Prescott, W. S. Sharpe. Lieutenants A. Irvine Fortescue, W. G. Aviss. Serjeant E. B. Dewsbury.

The following periodicals have been received:—

British: Journal of the Royal United Service Institution, Journal of the Royal Institute of Public Health, Natal Agricultural Journal, Cavalry Journal, British Medical Journal, Lancet, Hospital, Army and Navy Gazette, Journal of Tropical Medicine, Transvaal Medical Journal, Guy's Hospital Gazette, Public Health, Medical Press and Circular, Proceedings of the Royal Society of Medicine, Royal Engineers' Journal, Journal of the Royal Sanitary Institute, Medical Review, St. Thomas's Hospital Gazette, Glasgow Companies R.A.M.C. (V.) Annual, Australasian Medical Gazette, All India Hospital Assistants' Journal, Journal of Tropical Veterinary Science, Indian Medical Gazette, Red Cross News, Journal of Hygiene, St. Bartholomew's Journal, Journal of United Service Institution of India, On the March.

Foreign: Annales de l'Institut Pasteur, Bulletin de l'Institut Pasteur, Norsk Tidjskrift vor Militärmedizin, Archiv für Schiffs- und Tropen-Hygiene, Archives de Médecine Navale, Annali de Medecina Navale, Giornale di Medicina Militare, Militärärzt, Revista de Sanidad Militar, Archives de Hygiene e Pathologia Exoticas, Journal de Physiologie et de Pathologie générale, Tidshrift i Militar Hälsovård, Military Surgeon (U.S.A.), American Medicine, Caducée, Russian Military Medical Journal, Japanese Military Medical Journal.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

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The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, &c., are kindly requested to register their special qualifications at Headquarters. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in January and July of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, &c., has been registered at Headquarters, no entry of such qualifications can be recorded in the Distribution List.

Letters regarding non-delivery of the Journal, or change of address, should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," War Office, Whitehall, London, S.W., and reach there not later than the 25th of each month.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, &c., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, &c., should be addressed to

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